IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appl. No.	:	10/693719
Applicant	:	Douglas Swarts
Filed	:	10/24/2003
TC/A.U.	:	3753
Examiner	:	Cloud K Lee
Confirmation No.	:	1572
Docket No.	:	PFI-P002
Customer No.	:	40418
Title	:	Waste evacuation system for a vehicle

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APPELLANT'S APPEAL BRIEF Under 37 C.F.R. § 41.37

Dear Sir:

Applicant (Appellant) hereby submits this Appeal Brief pursuant to 37 C.F.R. § 41.37 in connection with the above-referenced application and respectfully requests consideration by the Board of Patent Appeals and Interferences for allowance from a rejection decision by the Examiner. The Examiner's rejection decision ("Office Action" or "Office") was communicated on Jan 11, 2008 and rejected all claims (1-24). Applicant has submitted the fees for filing an Appeal Brief required by 37 C.F.R. § 41.20(b)(2). Applicant submitted a Notice of Appeal that was received on July 16, 2008.

02/19/2009 EFLORES 00000038 10693719
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Adjustment date: 02/19/2009 EFLORES
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01 FC:2402 -250.00 OP

Adjustment date: 02/19/2009 EFLORES
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I. REAL PARTY IN INTEREST

The real party in interest of Appellant is Douglas R. Swarts and Horst Brenner.

II. RELATED APPEALS AND INTERFERENCES

Appellant is unaware of any related appeals or interferences.

1) There are no prior or pending interferences.

2) There are no pending appeals before the USPTO.

3) There is no judicial proceeding related to Appellant's instant application or related applications.

III. STATUS OF THE CLAIMS

Claims 1-24 are pending in the application. No claims have been allowed.

All claims are on appeal.

Claims 1-24 are pending in the application. No claims have been allowed.

All claims are on appeal.

All claims have been rejected by the Examiner as follows.

Claims 1-12 and 14-24 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Schoellhorn et al. (US Patent No. US 6,607,009 B2) ("Schoellhorn").

Claim 13 stands rejected 35 U.S.C. § 103(a) as being unpatentable over Schoellhorn et al. (US Patent No. US 6,607,009 B2) in view of Dussault (US Patent No. US 6,224,345).

IV. STATUS OF AMENDMENTS

No amendments have been filed after receipt of the latest rejection.

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V. SUMMARY OF THE CLAIMED SUBJECT MATTER

Appellant has indicated below representative Figures/Specifications. Appellant has not listed all figures or places in the specification. If the Office declares this unacceptable, Applicant reserves the right to amend the Appeal.

1. A fluid transfer system (Figures: 11, 36, 37, 41. Specification: page 14, lines 7-12, 17-19; page 15, lines 10-14) comprising:

one or more tanks capable of holding said fluid; (Figures: Figure 11 at 1106, 1108; Figure 37 at 3710, 3714; Figure 41 at Black Water, Gray Water. Specification: page 18, lines 22-23; page 34, line 4; page 39, line 20)

an extendible and retractable hose for transferring said fluid, (Figures: Figure 11 at 1104; Figure 36 at 3612, Figure 37 at 3702, Figure 41 at 4104. Specification: page 18, line 24; page 32, line 24; page 34, lines 5-6; page 39, line 18) wherein said extendible and retractable hose has two ends, (Figures: Figure 24 one end attached at 2404, other end near 2406; Figure 25 one end attached at 2504, other end 2506; Figure 37 one end attached at 3704, other end attached to nozzle 3708. Specification: page 22, lines 12-14, 18-20; page 34, lines 3-13) a first end in fluid communication with said one or more tanks, (Figures: Figure 37 one end attached at 3704 in communication via 3713, 3712, 3711 to black water tank 3710, and via 3713, 3716, 3715 to gray water tank 3714. Specification: page 34, lines 3-13) and a second end having an attached nozzle, (Figures: Figure 10 at 1016; Figure 11 at 1102; Figure 12 at 1206; Figure 29 at 2916; Figure 30 at 3002; Figure 31 at 3114; Figure 32 at 3214; Figure 33 at 3314; Figure 34 at 3414; Figure 35 at 3514; Figure

36 at 3614; Figure 37 at 3708; Figure 41 at 4102. Specification: page 18, lines 3-5, 23-24; page 19, lines 7-9; page 24, lines 11-16; page 25, lines 9-12; page 26, lines 2-6; page 27, lines 14-19; page 28, lines 20-23; page 30, lines 1-13; page 32, lines 4-6; page 33, lines 5-7; page 34, lines 4-6; page 39, lines 18-19) said extendible and retractable hose extendible so said nozzle is capable of being in fluid communication with a receiving receptacle for transfer of said fluid, and; (Figures: Figure 11 at notation "extend"; Figure 24 at 2410; Figure 25 at 2510; Figure 26 at 2610; Figure 27 at 2710; Figure 30 at notation "extend"; Figure 37 notation ←→ near 3708. Specification: page 15, lines 10-18; page 18, lines 23-24; page 21, lines 22-24; page 22, lines 14, 20; page 23, lines 4, 13-14; page 25, lines 1-12; page 34, lines 3-5, 21-24; page 35, lines 1-11.)

wherein said second end is extended and retraced in response to gas pressure inside of said extendible and retractable hose. (Figures: Figure 29, hose 2914 end at nozzle 2916, pressure/vacuum at 2920; Figure 30, hose 3003 end at nozzle 3002, pressure at 3020; Figure 32, hose 3212 end at nozzle 3214, pressure/vacuum at extend/retract module 3224; Figure 33, hose 3312 end at nozzle 3314, pressure/vacuum at extend/retract module 3324; Figure 34, hose 3412 end at nozzle 3414, pressure/vacuum at extend/retract module 3424; Figure 35, hose 3512 end at nozzle 3514, pressure/vacuum at extend/retract module 3524; Figure 32, hose 3612 end at nozzle 3614, pressure/vacuum at extend/retract module 3624; Figure 37 hose 3702 end at nozzle 3708, pressure/vacuum via 3725 and 3720, 3730, 3742 via various tubes and valves; Figure 38, at module 3808; Figure 39; Figure 40. Specification: page 14, lines 17-18; page 19, lines 17-23; page 20, lines 1-2; page 24, lines 1-4, 11-12, 19-24; page 25, lines 1-12, 19-21, page 26, lines 1-5; page 27, lines 19-24; page 28, lines 1, page 29, lines 1-7; page 30, lines 15-21; page 32, lines 8-14; page 33, lines 13-19; very detailed explanation page 35, line 12 to page 39, line 3; page 39, lines 4-16.)

2. The system of claim 1 wherein said extended second end of said extendible and retractable hose is retractable in response to gas pressure inside of said extendible and retractable hose. (Figure 37 hose 3702 end at nozzle 3708, pressure/vacuum via 3725 and 3720, 3730, 3742 via various tubes and valves. Specification: very detailed explanation page 35, line 12 to page 39, line 3.)

3. The system of claim 1 wherein said fluid is a liquid. (Figure 32. Specification page18, lines 8-10.)

4. The system of claim 3 wherein said liquid is selected from the group consisting of water, liquid waste, black water, grey water, effluent, and water containing waste materials. (Figure 37 at 3710, 3714; Figure 41 at black water, gray water, fresh water. Specification page18, lines 9-18; page 39 line 20.)

5. The system of claim 1 wherein said system is located on a vehicle. (Figure 14. Specification page 14, lines 3-12.)

6. The system of claim 1 wherein said gas is air. (Figure 36 at 3620, Figure 37 at 3720, 3730. Specification page 14, lines 17-18; page 34, line 20.)

7. The system of claim 1 wherein said gas pressure is above local atmospheric pressure for extending said extendible and retractable hose. (Figure 37 at 3720, 3730. Specification page 19, lines 17-23.)

8. The system of claim 1 wherein said gas pressure is below local atmospheric pressure for retracting said extendible and retractable hose. (Figure 37 at 3742, through 3745, 3746, 3725. Specification page 19, lines 17-23.)

9. The system of claim 1 further comprising venting ports selected from the group consisting of venting ports for said one or more tanks, (Figure 30 at 3026, 3028. Specification page 25, line 9 to page 26 line 9.) and venting port for said extendible and retractable hose. (Figure 30 at 3030, 3032, 3034. Specification page 25, line 9 to page 26 line 9.)

10. The system of claim 1 wherein said extendible and retractable hose is selected from the group consisting of an axially extendible and compressible hose (Figure 36 at 3612; Figure 37 at 3702. Specification page 40 line 13 to page 41 line 10.), an accordion-type construction hose (Figure 36 at 3612; Figure 37 at 3702. Specification page 36, lines 1-4; page 40 line 13 to page 41 line 10.), an expandable and collapsible type hose (Figure 36 at 3612; Figure 37 at 3702. Specification page 36, lines 1-4; page 40 line 13 to page 41 line 10..), a hose having a spirally wound wall (Figure 36 at 3612; Figure 37 at 3702. Specification page 36, lines 1-4; page 40 line 13 to page 41 line 10.), a flexible hose having adjacent transverse accordion pleats (Figure 36 at 3612; Figure 37 at 3702. Specification page 36, lines 1-4; page 40 line 13 to page 41 line 10.), and a longitudinally extensible and compressible hose. (Figure 36 at 3612; Figure 37 at 3702. Specification page 36, lines 1-4; page 40 line 13 to page 41 line 10.)

11. The system of claim 1 wherein said gas pressure is supplied from a pressurized gas tank. (Figure 37 at 3730. Specification page 36, lines 6-8.)

12. The system of claim 7 wherein said above local atmospheric pressure is supplied from a pressurized gas tank. (Figure 37 at 3730. Specification page 36, lines 6-8.)

13. The system of claim 8 wherein said below local atmospheric pressure is generated by a Venturi tube type device (Figure 37 at 3742. Specification page 37, lines 6-22.) driven from a pressurized gas tank. (Figure 37 at 3730. Specification page 36, lines 6-8; page 37, lines 6-22.)

14. A vehicle waste transfer system (Figures: Figure 4 at 404; Figure 11 at 1106, 1108; Figure 14 at 1404; Figure 37 at 3710, 3714; Figure 41 at Black Water, Gray Water. Specification: page 14, lines 3-4; page 18, lines 22-23; page 34, line 4; page 39, line 20) comprising:

one or more tanks capable of holding said waste; (Figures: Figure 11 at 1106, 1108; Figure 37 at 3710, 3714; Figure 41 at Black Water, Gray Water. Specification: page 18, lines 22-23; page 34, line 4; page 39, line 20)

an extendible and retractable hose for transferring said waste, (Figures: Figure 11 at 1104; Figure 36 at 3612, Figure 37 at 3702, Figure 41 at 4104. Specification: page 18, line 24; page 32, line 24; page 34, lines 5-6; page 39, line 18) wherein said extendible and retractable hose has two ends, (Figures: Figure 24 one end attached at 2404, other end near 2406; Figure 25 one end attached at 2504, other end 2506; Figure 37 one end attached at 3704, other end attached to nozzle 3708. Specification: page 22, lines 12-14, 18-20; page 34, lines 3-13) a first end in communication with said one or more tanks,

(Figures: Figure 37 one end attached at 3704 in communication via 3713, 3712, 3711 to black water tank 3710, and via 3713, 3716, 3715 to gray water tank 3714. Specification: page 34, lines 3-13) and a second end having an attached nozzle, (Figures: Figure 10 at 1016; Figure 11 at 1102; Figure 12 at 1206; Figure 29 at 2916; Figure 30 at 3002; Figure 31 at 3114; Figure 32 at 3214; Figure 33 at 3314; Figure 34 at 3414; Figure 35 at 3514; Figure 36 at 3614; Figure 37 at 3708; Figure 41 at 4102. Specification: page 18, lines 3-5, 23-24; page 19, lines 7-9; page 24, lines 11-16; page 25, lines 9-12; page 26, lines 2-6; page 27, lines 14-19; page 28, lines 20-23; page 30, lines 1-13; page 32, lines 4-6; page 33, lines 5-7; page 34, lines 4-6; page 39, lines 18-19) said extendible and retractable hose extendible so said nozzle is capable of transferring said waste a distance from said vehicle; (Figures: Figure 11 at notation "extend"; Figure 24 at 2410; Figure 25 at 2510; Figure 26 at 2610; Figure 27 at 2710; Figure 30 at notation "extend"; Figure 37 notation ←→ near 3708. Specification: page 15, lines 10-18; page 18, lines 5-8, 23-24; page 21, lines 22-24; page 22, lines 14, 20; page 23, lines 4, 13-14; page 25, lines 1-12; page 34, lines 3-5, 21-24; page 35, lines 1-11.)

wherein said second end is extended in response to gas pressure applied to the inside of said extendible and retractable hose. (Figures: Figure 29, hose 2914 end at nozzle 2916, pressure/vacuum at 2920; Figure 30, hose 3003 end at nozzle 3002, pressure at 3020; Figure 32, hose 3212 end at nozzle 3214, pressure/vacuum at extend/retract module 3224; Figure 33, hose 3312 end at nozzle 3314, pressure/vacuum at extend/retract module 3324; Figure 34, hose 3412 end at nozzle 3414, pressure/vacuum at extend/retract module 3424; Figure 35, hose 3512 end at nozzle 3514, pressure/vacuum at extend/retract module 3524; Figure 32, hose 3612 end at nozzle 3614, pressure/vacuum at extend/retract module 3624; Figure 37 hose 3702 end at nozzle 3708, pressure/vacuum via 3725 and 3720, 3730,

3742 via various tubes and valves; Figure 38, at module 3808; Figure 39; Figure 40. Specification: page 14, lines 17-18; page 19, lines 17-23; page 20, lines 1-2; page 24, lines 1-4, 11-12, 19-24; page 25, lines 1-12, 19-21, page 26, lines 1-5; page 27, lines 19-24; page 28, lines 1, page 29, lines 1-7; page 30, lines 15-21; page 32, lines 8-14; page 33, lines 13-19; very detailed explanation page 35, line 12 to page 39, line 3; page 39, lines 4-16.)

15. The system of claim 14 wherein said first end in communication with said one or more tanks is through one or more valves connected between said one or more tanks and said first end. (Figure 37 valves at 3712, and 3716, tanks at 3710, and 3714. Specification page 34 line 21 to page 35 line 11.)

16. The system of claim 14 wherein said gas pressure is supplied from a tank of compressed air. (Figure 37 at 3730. Specification page 36, lines 6-12.)

17. The system of claim 16 wherein said tank of compressed air has in input port (Figure 36 at 3623; Figure 37 at 3729. Specification page 33 lines 19 to page 34 line 2; page 36, lines 20-23.) and an output port, (Figure 36 at 3625, Figure 37 at 3723. Specification page 33 lines 19 to page 34 line 2; page 36, lines 6-12.) said input port in communication with a one-way valve for receiving air, (Figure 36 at 3630; Figure 37 at 3720, 3722, 3723, 3728. Specification page 36, lines 5-12.) and said output port in communication with a one-way valve for supplying air. (Figure 37 at 3728. Specification page 36, lines 13-24.)

18. The system of claim 17 wherein said source of receiving air is selected from the group consisting of an on-vehicle air compressor(Figure 35 at 3524; Figure 37 at 3720.

Specification page 36, lines 8-24.), and an external connector for connection to a external source of compressed air. (Figure 34 at 3420; Figure 36 at 3620; Figure 37 at 3720, 3722, 3723, 3728. Specification page 36, lines 8-24.)

19. The system of claim 14 further comprising a supporting member attached to said vehicle for supporting said extendible and retractable hose. (Figure 36 at 3606; Figure 37 at 3706. Specification page 32 line 24 to page 33 line 3; page 34, lines 5-6; page 35, lines 12-14.)

20. The system of claim 19 wherein said supporting member is a tube larger in diameter than diameter of said extendible and retractable hose. (Figure 36 at 3606; Figure 37 at 3706. Specification page 32 line 24 to page 33 line 3; page 34, lines 5-6; page 35, lines 12-14.)

21. The system of claim 19 further comprising a storage container for said extendible and retractable hose when in a retracted state. (Figure 36 at 3606; Figure 37 at 3706. Specification page 32 line 24 to page 33 line 3; page 34, lines 5-6; page 35, lines 12-14.)

22. A system for transferring liquid waste (Figures: 11, 36, 37, 41. Specification: page 14, lines 7-12, 17-19; page 15, lines 10-14) comprising:

one or more tanks capable of holding said liquid waste; (Figures: Figure 11 at 1106, 1108; Figure 37 at 3710, 3714; Figure 41 at Black Water, Gray Water. Specification: page 18, lines 22-23; page 34, line 4; page 39, line 20)

an extendible and retractable hose for transferring said liquid waste, (Figures: Figure 11 at 1104; Figure 36 at 3612, Figure 37 at 3702, Figure 41 at 4104. Specification: page 18,

line 24; page 32, line 24; page 34, lines 5-6; page 39, line 18) wherein said extendible and retractable hose has two ends, (Figures: Figure 24 one end attached at 2404, other end near 2406; Figure 25 one end attached at 2504, other end 2506; Figure 37 one end attached at 3704, other end attached to nozzle 3708. Specification: page 22, lines 12-14, 18-20; page 34, lines 3-13) a first end for receiving liquid waste from said one or more tanks, (Figures: Figure 37 one end attached at 3704 in communication via 3713, 3712, 3711 to black water tank 3710, and via 3713, 3716, 3715 to gray water tank 3714. Specification: page 34, lines 3-13) and a second end having an attached nozzle, (Figures: Figure 10 at 1016; Figure 11 at 1102; Figure 12 at 1206; Figure 29 at 2916; Figure 30 at 3002; Figure 31 at 3114; Figure 32 at 3214; Figure 33 at 3314; Figure 34 at 3414; Figure 35 at 3514; Figure 36 at 3614; Figure 37 at 3708; Figure 41 at 4102. Specification: page 18, lines 3-5, 23-24; page 19, lines 7-9; page 24, lines 11-16; page 25, lines 9-12; page 26, lines 2-6; page 27, lines 14-19; page 28, lines 20-23; page 30, lines 1-13; page 32, lines 4-6; page 33, lines 5-7; page 34, lines 4-6; page 39, lines 18-19) said extendible and retractable hose extendible a distance from said vehicle so said nozzle is capable of transferring said received liquid waste; (Figures: Figure 11 at notation "extend"; Figure 24 at 2410; Figure 25 at 2510; Figure 26 at 2610; Figure 27 at 2710; Figure 30 at notation "extend"; Figure 37 notation ←→ near 3708. Specification: page 15, lines 10-18; page 18, lines 5-8, 23-24; page 21, lines 22-24; page 22, lines 14, 20; page 23, lines 4, 13-14; page 25, lines 1-12; page 34, lines 3-5, 21-24; page 35, lines 1-11.)

wherein said second end is extendible and retractable in response to gas pressure applied to the inside of said extendible and retractable hose. (Figures: Figure 29, hose 2914 end at nozzle 2916, pressure/vacuum at 2920; Figure 30, hose 3003 end at nozzle 3002, pressure at 3020; Figure 32, hose 3212 end at nozzle 3214, pressure/vacuum at

extend/retract module 3224; Figure 33, hose 3312 end at nozzle 3314, pressure/vacuum at extend/retract module 3324; Figure 34, hose 3412 end at nozzle 3414, pressure/vacuum at extend/retract module 3424; Figure 35, hose 3512 end at nozzle 3514, pressure/vacuum at extend/retract module 3524; Figure 32, hose 3612 end at nozzle 3614, pressure/vacuum at extend/retract module 3624; Figure 37 hose 3702 end at nozzle 3708, pressure/vacuum via 3725 and 3720, 3730, 3742 via various tubes and valves; Figure 38, at module 3808; Figure 39; Figure 40. Specification: page 14, lines 17-18; page 19, lines 17-23; page 20, lines 1-2; page 24, lines 1-4, 11-12, 19-24; page 25, lines 1-12, 19-21, page 26, lines 1-5; page 27, lines 19-24; page 28, lines 1, page 29, lines 1-7; page 30, lines 15-21; page 32, lines 8-14; page 33, lines 13-19; very detailed explanation page 35, line 12 to page 39, line 3; page 39, lines 4-16.)

23. The system of claim 22 further comprising a support device through which said extendible and retractable hose may extend and retract without substantial resistance. (Figure 36 at 3606; Figure 37 at 3706. Specification page 32 line 24 to page 33 line 3; page 34, lines 5-6; page 35, lines 12-14.)

24. The system of claim 22 wherein said extendible and retractable hose when transferring said liquid waste has said second end at an equal or lower elevation than said first end. (Figure 11; Figure 29; Figure 30; Figure 41. Specification page 15, lines 9-18; page 34, lines 3-13.)

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VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues presented on appeal are whether Applicant's claims 1-24 for the reasons stated in the Status of the Claims are unpatentable.

First

Claims 1-12 and 14-24 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Schoellhorn et al. (US Patent No. US 6,607,009 B2) ("Schoellhorn").

Second

Claim 13 stands rejected 35 U.S.C. § 103(a) as being unpatentable over Schoellhorn et al. (US Patent No. US 6,607,009 B2) in view of Dussault (US Patent No. US 6,224,345).

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VII. ARGUMENT

Each claim is addressed below, however, Claim 1 is considered particularly relevant because it is representative of the other independent claims and thus also representative of what the dependent claims are dependent on. As may be seen from the chart below the Examiner has relied on Schoellhorn for all rejections but one after the first appeal. Claim dependency is indicated via indentation (leftmost being independents).

CLAIM #	3rd OA 1/11/2008 Rejection	1st Appeal filed 11/14/2006	2nd OA 3/8/2006 Rejection	1st OA 1/21/2005 Rejection
1	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
2	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
3	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
4	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
5	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
6	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
7	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
12	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
8	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
13	103(a) Schoellhorn in view of Dussault		102(e) Schoellhorn	102(e) Schoellhorn
9	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
10	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
11	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
14	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
15	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
16	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
17	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
18	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
19	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
20	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
21	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
22	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
23	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn
24	102(e) Schoellhorn		102(e) Schoellhorn	102(e) Schoellhorn

Applicant respectfully submits the Examiner is sand-bagging the application because the "new grounds" of rejection relied upon to yank the first appeal back into prosecution is Dussault which issued in 2001 more than a year before Applicant's priority date. Applicant submits that Dussault is not a new ground of rejection and

requests that the Board direct the Examiner to explain why if he was diligently pursuing prosecution, the reference just now has come to light. Applicant is obviously concerned that such a "game" may be relied upon indefinitely by the Examiner to deny Applicant any sort of finality or to allow this appeal to reach the Board.

INTRODUCTION

The present invention relates to a waste evacuation system for a vehicle having an extendible and retractable hose with a nozzle for transferring the waste. Operation of the system is assisted by several features.

Previous approaches to dumping of recreational vehicle (RV) waste required the following steps:

0) Using gloves and covering your nose:

1) Locate sewer hose storage container

2) Remove (possibly still wet) sewer hose from storage container

3) Remove sewage tank dump cap taking care not to get wet

4) Connect sewer hose to sewage tank

5) Drag the other end of the sewer hose and place it in receptacle

6) Open black water sewer tank valve.

7) Wait until black tank empty then close black water tank valve.

8) Open gray water sewer tank valve.

9) Wait until gray tank empty then close gray water tank valve.

10) Open clear water tank valve for a short time to flush out the hose.

11) Disconnect sewer hose from sewage tank.

12) Replace tank dump cap.

13) Store sewer hose back in storage container.

Applicant's approach as fully illustrated is as follows:

0) Using your bare hands:

1) Open a nozzle door

2) Hold nozzle via a handle

3) Press key fob to extend hose as you guide it to the receptacle

4) Place nozzle in receptacle

5) Open valve in nozzle

6) Press key fob to open black tank valve

7) Wait until black tank empty then press key fob to close black water tank valve.

8) Press key fob to open gray water sewer tank valve.

9) Wait until gray tank empty then press key fob to close gray water tank valve.

10) Press key fob to open clear water tank valve for a short time to flush out the hose (optional).

11) Close valve on nozzle

12) Press key fob to retract hose and nozzle into nozzle door.

13) Close nozzle door.

Immediately apparent is that the Appellant's approach has the sewer hose and nozzle permanently attached, the sewer hose extends and retracts itself, and gloves are not needed.

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REMARKS/ARGUMENTS

Applicant respectfully requests reconsideration of this application in view of the following remarks.

Claims 1-12 and 14-24 Rejection under 35 U.S.C. § 102(e) – Schoellhorn

The Examiner has stated on page 3 and 4 of the Office Action the following ramble-on run-together rejection for claims 1-12 and 14-24.

Schoellhorn et al. disclose[sic] a fluid transfer system comprising two tanks (12 and 10), an extendible and retractable hose (42) for transferring fluid, wherein said extendible and retractable hose has two ends, a first end (the end inside structure 30) in fluid communication with both tanks, and a second end (located about cover 54 is) **having an attached nozzle (the nozzle is attached to the end of the hose (42), after removing the cover (54)**, the fluid can remove[sic] from the hose through the nozzle), said extendible and retractable hose extendible so the nozzle is capable of being in fluid communication with a receiving receptacle (see Col 4 lines 5-10), wherein said second end is extended and retraced[sic] in response to gas pressure inside of said extendible and retractable hose (see Col 3 lines 65 to Col 4 lines 27), wherein said fluid is a liquid (see black tank 10 and gray tank 12), wherein said system is located on a vehicle (see abstract), wherein said gas is air (see air tank 46), wherein said gas pressure is above local atmospheric pressure for extending said extendible and retractable hose (see Col 3 lines 65 to Col 4 lines 27, also note, the gas pressure MUST be above local atmospheric pressure for extending the hose), wherein said gas pressure is below local atmospheric pressure for retracting the hose (see Col 3 lines 65 to Col 4 lines 27), wherein the system further comprising a venting port (18), wherein said extendible and retractable hose is a longitudinally extensible and compressible hose (figure 2 of Schoellhorn

et al. shows a compressible or flexible hose), wherein said gas pressure is supplied from a pressurized gas tank (46). Regarding claim 17, Schoellhorn et al. shows the tank (46) is between an input port and output port (see figure 1) and the input port and output port are in communication with a one way valve (44 and 50), wherein said source of receiving air is an air compressor (see Col 3 lines 28-33), wherein the system further comprising a supporting member (30), and wherein said supporting member is a tube larger in diameter than diameter of said extendible and retractable hose and the supporting member is also a storage container for the hose. Regarding claim 23, the hose (42) may extend and retract without substantial resistance through the supporting member (30) and the hose when transferring the liquid waste has the second end at an equal or lower elevation than said first end (see figure 2). [Emphasis added.]

Claim 1 Rejection under 35 U.S.C. § 102(e) – Schoellhorn

Applicant's claim 1 recites

1. A fluid transfer system comprising:

one or more tanks capable of holding said fluid;

an extendible and retractable hose for transferring said fluid, wherein said extendible and retractable hose has two ends, a first end in fluid communication with said one or more tanks, and **a second end having an attached nozzle**, said extendible and retractable hose extendible so said nozzle is capable of being in fluid communication with a receiving receptacle for transfer of said fluid, and;

wherein said second end is extended and retraced in response to gas pressure inside of said extendible and retractable hose.

[Emphasis added.]

The Examiner states on page 5 at 5.:

"Schoelhorn et al's system discloses **the nozzle is attached to the end of the hose (42)**, after removing the cover (54), the fluid can remove from the hose through the nozzle."

[Emphasis added.]

Applicant submits that the Examiner has failed to establish a *prima facie* rejection under 35 U.S.C. § 102(e) because "Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim." *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick* ("*Lindemann*"), 730 F.2d 1452, 1458 (Fed. Cir. 1984) (emphasis added). Additionally, each and every element of the claim must be *exactly* disclosed in the anticipatory reference. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 777 (Fed. Cir. 1985).

Schoellhorn does not disclose a nozzle. "42 is a hose as Schoellhorn states multiple times and "54" is a cover as Schoellhorn states multiple times.

"The pressure exerted on the end portion of the waste **hose 42**, capped by a detachably engageable **cover 54**, …" [Emphasis added.] Col 3, lines 38-39.

"After extending the waste **hose 42** the **cover 54** is removed …" [Emphasis added.] Col 3, line 45.

"...the waste **hose 42** as opposed to air pressure against the **cover 54**, ..." [Emphasis added.] Col 3, lines 49-50.

And most telling of the lack of disclosure of a nozzle is:

"The user then **removes the cover 54** and engages the waste hose 42 with the receptacle." [Emphasis added.] Col 4, lines 9-10. ...

"The user disengages the waste hose 42 from the receptacle and **replaces the cover 54**." [Emphasis added.] Col 4, lines 12-13.

Thus Schoellhorn discloses a cover. "Nozzle" is never mentioned anywhere in the cited reference. The cover 54 is used to cap the end of the hose.

There is a clear difference between a cap [cover 54] and a nozzle (Applicant). Anyone who has filled their car with gas, knows the difference, you grab the gas nozzle, remove the gas cap, insert the nozzle and fill the car with gas. A cap (cover) stops flow and a nozzle permits flow.

A cover (Schoellhorn) **is not the same as a nozzle** (Applicant).

Applicant submits that because Schoellhorn fails to disclose a nozzle that Schoellhorn cannot anticipate what Applicant has claimed. Applicant respectfully requests allowance of independent claim 1, and claims 2-12 which are dependent on claim 1.

Likewise:

Applicant's independent claim 14 recites

14. A vehicle waste transfer system comprising:

one or more tanks capable of holding said waste;

an extendible and retractable hose for transferring said waste, wherein said extendible and retractable hose has two ends, a first end in communication with said one or more tanks, and **a second end having an attached nozzle**, said extendible and retractable hose extendible so said nozzle is capable of transferring said waste a distance from said vehicle;

wherein said second end is extended in response to gas pressure applied to the inside of said extendible and retractable hose.

[Emphasis added.]

And

Applicant's independent claim 22 recites

22. A system for transferring liquid waste comprising:

one or more tanks capable of holding said liquid waste;

an extendible and retractable hose for transferring said liquid waste, wherein said extendible and retractable hose has two ends, a first end for receiving liquid waste from said one or more tanks, and **a second end having an attached nozzle**, said extendible and retractable hose extendible a distance from said vehicle so said nozzle is capable of transferring said received liquid waste;

wherein said second end is extendible and retractable in response to gas pressure applied to the inside of said extendible and retractable hose.

[Emphasis added.]

For the same reason as detailed in Applicant's claim 1 discussion above, Applicant submits that because Schoellhorn fails to disclose a nozzle that Schoellhorn cannot anticipate what Applicant has claimed in independent claims 14 and 22. Applicant respectfully requests allowance of independent claims 14 and 22, and claims 15-21, and claims 23-24 which are dependent on claims 14 and 22 respectively.

//

Claim 13 Rejection under 35 U.S.C. § 103(a) – Schoellhorn in view of Dussault

The Office at 4. states:

4. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schoellhorn et al. (US Patent No. 6,607,009) in view of Dussault (US Patent No. 6,224,345). Schoellhorn et al. disclose the below local atmospheric pressure is generated by a vacuum created by the vent pipe (18), however, Schoelhorn et al. fail to disclose a venturi tube device to generate a vacuum. Dussault discloses a venturi tube device to generate a vacuum (see figure 8). It would have obvious to one having ordinary skill in the art at the time the invention was made to have provided a venture tube device in arrangement with Schoellhorn' system in order to provide a higher efficiency vacuum generator to generate a vacuum inside the system and require less energy consumption of the system.

Applicant submits that claim 13 is ultimately dependent on independent claim 1 and as such inherits the limitations of the independent claim. As detailed above in the **Claim 1 Rejection under 35 U.S.C. § 102(e) – Schoellhorn** discussion and incorporated herein fully, the cited art fails to disclose limitations in independent claim 1 nor does the combination of the cited art disclose or suggest the limitation of a nozzle attached to a hose limitation in Applicant's claim 13. Further, the combination of the art does not make obvious the further limitation of Applicant's claim 13 [t]he apparatus of claim 8… using a Venturi type device…. Applicant respectfully requests allowance of claim 13.

Claim 13 Rejection under 35 U.S.C. § 103(a)

Applicant submits that the Office has failed to establish obviousness for a variety of reasons as noted below.

The Court in *KSR International Co.* v. *Teleflex Inc.* 127 S. Ct. 1727, 550 U.S. _, 82 USPQ2d 1385 (2007) ("KSR") reaffirmed that the standard for determining obviousness is as is set forth in *Graham* v. *John Deere Co.* 383 U.S. 1, 148 USPQ 459 (1966 ("Graham"). Further under 35 U.S.C. 132 Applicant is entitled to the rationale for the rejection.

As enumerated by the Court in KSR there must be clear articulation of the reason(s) why the claimed invention is considered obvious. The Court further gave seven rationales that my be applicable.

Applicant submits that the Office has failed to establish reasonable rational support for the legal conclusion of obviousness.

Firstly, under the rationale of (A) Combining prior art elements according to known methods to yield predictable results; the following must all be established;

(1) a finding that the prior art included each element claimed, although not necessarily in a single prior art reference, with the only difference between the claimed invention and the prior art being the lack of actual combination of the elements in a single prior art reference;

(2) a finding that one of ordinary skill in the art could have combined the elements as claimed by known methods, and that in combination, each element merely would have performed the same function as it did separately;

(3) a finding that one of ordinary skill in the art would have recognized that the results of the combination were predictable; **and**

(4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

(Emphases added.)

With respect to (1): there is a major difference between the claimed invention which has a nozzle attached to a hose and the combination art of Schoellhorn and Dussault because neither Schoellhorn nor Dussault ever mentions a nozzle. Therefore this element is not met.

For at least the above reasons, the rationale of (A) Combining prior art elements according to known methods to yield predictable results has not been met.

//

Secondly, under the rationale of (B) Simple substitution of one known element for another to obtain predictable results; the following must all be established;

(1) a finding that the prior art contained a device (method, product, etc.) which differed from the claimed device by the substitution of some components (step, element, etc.) with other components;
(2) a finding that the substituted components and their functions were known in the art;
(3) a finding that one of ordinary skill in the art could have substituted one known element for another, **and** the results of the substitution would have been predictable; and
(4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness. (Emphases added.)

With respect to (1): Applicant submits that neither Schoellhorn nor Dussault qualify for differing from the claimed device by substitution of the other. First, to substitute Schoellhorn with components of Dussault would differ by among other things, there being no nozzle attached to a hose. Second, to substitute Dussault with components of Schoellhorn would differ by among other things, there being no nozzle attached to a hose.. Therefore this element is not met.

For at least the above reasons, the rationale of (B) Simple substitution of one known element for another to obtain predictable results has not been met.

//

Thirdly, under the rationale of (C) Use of known technique to improve similar devices (methods, or products) in the same way; the following must all be established;

(1) a finding that the prior art contained a "base" device (method, or product) upon which the claimed invention can be seen as an "improvement;"
(2) a finding that the prior art contained a "comparable" device (method, or product that is not the same as the base device) that was improved in the same way as the claimed invention;
(3) a finding that one of ordinary skill in the art could have applied the known "improvement" technique in the same way to the "base" device (method, or product) and the results would have been predictable to one of ordinary skill in the art; **and**
(4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.
(Emphases added.)

With respect to (1): The Office has not specified a "base" device or an assertion that the claimed invention can be seen as an improvement. Therefore this element is not met.

With respect to (2): The Office has failed to identify a "comparable" device that was improved in the same way as the claimed invention. Therefore this element is not met.

With respect to (3): Since the Office has failed to identify a "known improvement" or a "base" device it has not shown the "known improvement" being applied to a "base" device with a predictable result. Therefore this element is not met.

For at least the above reasons, the rationale of (C) Use of known technique to improve similar devices (methods, or products) in the same way has not been met.

//

Fourthly, under the rationale of (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; the following must all be established;

(1) a finding that the prior art contained a "base" device (method, or product) upon which the claimed invention can be seen as an "improvement;"
(2) a finding that the prior art contained a known technique that is applicable to the base device (method, or product);
(3) a finding that one of ordinary skill in the art would have recognized that applying the known technique would have yielded predictable results and resulted in an improved system; **and**
(4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.
(Emphases added.)

With respect to (1): The Office has not specified a "base" device or an assertion that the claimed invention can be seen as an improvement. Therefore this element is not met.

With respect to (2): The Office has failed to identify a known technique that is applicable to the base device. Therefore this element is not met.

With respect to (3): Since the Office has failed to show applying a known technique to the base device would have yielded predictable results. Therefore this element is not met.

For at least the above reasons, the rationale of (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results has not been met.

//

Fifthly, under the rationale of (E) "Obvious to try"- choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; the following must all be established;

(1) a finding that at the time of the invention, there had been a recognized problem or need in the art, which may include a design need or market pressure to solve a problem;
(2) a finding that there had been a finite number of identified, predictable potential solutions to the recognized need or problem;
(3) a finding that one of ordinary skill in the art could have pursued the known potential solutions with a reasonable expectation of success; **and**
(4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness. (Emphases added.)

With respect to (1): The Office has not identified a recognized problem or need in the art. Therefore this element is not met.

With respect to (2): The Office has failed to identify a finite number of identified, predictable potential solutions to the recognized need or problem. Therefore this element is not met.

With respect to (3): Since the Office has failed to show a recognized problem or need in the art and has failed to identify a finite number of identified, predictable potential solutions to the recognized need or problem it cannot show a reasonable expectation of success. Therefore this element is not met.

For at least the above reasons, the rationale of (E) "Obvious to try"- choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success has not been met.

//

Sixthly, under the rationale of (F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; the following must all be established;

(1) a finding that the scope and content of the prior art, whether in the same field of endeavor as that of the applicant's invention or a different field of endeavor, included a similar or analogous device (method, or product);
(2) a finding that there were design incentives or market forces which would have prompted adaptation of the known device (method, or product);
(3) a finding that the differences between the claimed invention and the prior art were encompassed in known variations or in a principle known in the prior art;
(4) a finding that one of ordinary skill in the art, in view of the identified design incentives or other market forces, could have implemented the claimed variation of the prior art, **and** the claimed variation would have been predictable to one of ordinary skill in the art; and
(5) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.
(Emphases added.)

With respect to (1): The Office has not identified a different field of endeavor that included a similar or analogous device. Therefore this element is not met.

With respect to (2): The Office has failed to identify design incentives or market forces which would have prompted adaptation of the known device. Therefore this element is not met.

With respect to (3): The Office has failed to show that the differences between the claimed invention and the prior art were encompassed in known variations or in a principle known in the prior art. Therefore this element is not met.

With respect to (4): Since the Office has failed to identify design incentives or other market forces it cannot show how one of ordinary skill in the art, in view of the identified design incentives or other market forces, could have implemented the claimed variation of the prior art, and the claimed variation would have been predictable. Therefore this element is not met.

For at least the above reasons, the rationale of (F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art has not been met.

//

Seventhly, under the rationale of (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention; the following must all be established;

(1) a finding that there was some teaching, suggestion, or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;
(2) a finding that there was reasonable expectation of success; **and**
(3) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness. (Emphases added.)

With respect to (1):

Firstly:

The Office has not identified an explicit teaching, suggestion, or motivation in the art. Rather the Office has relied on **hindsight** to try and cobble together references in an attempt to make Applicant's invention appear obvious. Therefore this element is not met.

Secondly:

Here the Office has cited as the "reason"

It would have obvious to one having ordinary skill in the art at the time the invention was made to have provided a venture [sic] tube

device in arrangement with Schoellhorn' system in order to provide a higher efficiency vacuum generator to generate a vacuum inside the system and require less energy consumption of the system.

Applicant submits that it is well known to those familiar with the venturi tube that using compressed air to generate a vacuum is much more inefficient than a vacuum pump. It takes large amounts of high pressure to generate very small levels of vacuum. Thus the given rationale does not make sense.

Thirdly:

The Examiner has conclusionary stated that the references may be combined but has provided nothing other than hindsight and using Applicant 's teachings to suggest such. Applicant's invention has a much different arrangement (see Applicant's Figure 37) than either of the references and the Examiner has failed to show how the references can be combined to yield what Applicant has claimed.

Additionally with respect to (G):

First, under Graham "A court must ask whether the improvement is more than the predictable use of prior-art elements according to their established functions."

As KSR noted *In re Kahn*, 441 F. 3d 977, 988 (CA Fed. 2006) (.[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some

articulated reasoning with some rational underpinning to support the legal conclusion of obviousness .).

Quoting from KSR "As is clear from cases such as *Adams*, (*United States* v. *Adams*, 383 U. S. 39, 40 (1966)) a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.

Firstly:

Claim 13 is dependent on claim 1, and as explained above at the **claim 1 discussion** Schollehorn fails to disclose a nozzle, additionally Schollehorn in view of Dussault fails to disclose or suggest a nozzle attached to a hose. Neither Schollehorn nor Dussault individually or in combination even mention a single time the word "nozzle". Therefore Schollehorn in view of Dussault does not make obvious what Applicant has claimed. Applicant requests allowance of claim 13.

Secondly:

The Examiner takes liberty and states:

Schoellhorn et al. disclose the below local atmospheric pressure is generated by a vacuum created by the vent pipe (18)

Applicant submits this is false. First, for the vent pipe to vent something into the atmosphere requires that the pressure in the vent pipe be above that of the atmosphere otherwise noting will move from the vent pipe to the atmosphere. Second, a vent pipe does not create a vacuum as it is a pipe and simply conveys gases. Third, a check valve does not create a vacuum, it simple prevents a back flow (i.e. it allows flow in a single direction). Gases flowing through a check valve just flow in one direction, no vacuum is created. Therefore Schollehorn in view of Dussault does not make obvious what Applicant has claimed. Applicant requests allowance of claim 13.

Thirdly:

Here the Office has cited as the "reason"

It would have obvious to one having ordinary skill in the art at the time the invention was made to have provided a venture [sic] tube device in arrangement with Schoellhorn' system in order to provide a higher efficiency vacuum generator to generate a vacuum inside the system and require less energy consumption of the system.

Applicant submits that it is well known to those familiar with the venturi tube that using compressed air to generate a vacuum is much more inefficient than a vacuum pump. It takes large amounts of high pressure to generate very small levels of vacuum. Thus the given rationale does not make sense.

For at least the above reasons, the rationale of (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention has not been met.

For the above reasons, Applicant respectfully requests removal of this rejection and allowance of all claims.

//

CONCLUSION

Applicant submits that the rejection of dependent claims not specifically addressed, are addressed by Applicant's arguments to the independent claims on which they depend.

Applicant respectfully submits that the appealed claims in this application are patentable, and requests that the Board of Patent Appeals and Interferences direct allowance of all claims.

Respectfully submitted,

Heimlich Law

02/17/2009

Date

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VIII. CLAIMS APPENDIX

The claims involved in this appeal (all pending claims) are as follows:

CLAIMS

What is claimed is:

1. A fluid transfer system comprising:

one or more tanks capable of holding said fluid;

an extendible and retractable hose for transferring said fluid, wherein said extendible and retractable hose has two ends, a first end in fluid communication with said one or more tanks, and a second end having an attached nozzle, said extendible and retractable hose extendible so said nozzle is capable of being in fluid communication with a receiving receptacle for transfer of said fluid, and;

wherein said second end is extended and retraced in response to gas pressure inside of said extendible and retractable hose.

2. The system of claim 1 wherein said extended second end of said extendible and retractable hose is retractable in response to gas pressure inside of said extendible and retractable hose.

3. The system of claim 1 wherein said fluid is a liquid.

4. The system of claim 3 wherein said liquid is selected from the group consisting of water, liquid waste, black water, grey water, effluent, and water containing waste materials.

5. The system of claim 1 wherein said system is located on a vehicle.

6. The system of claim 1 wherein said gas is air.

7. The system of claim 1 wherein said gas pressure is above local atmospheric pressure for extending said extendible and retractable hose.

8. The system of claim 1 wherein said gas pressure is below local atmospheric pressure for retracting said extendible and retractable hose.

9. The system of claim 1 further comprising venting ports selected from the group consisting of venting ports for said one or more tanks, and venting port for said extendible and retractable hose.

10. The system of claim 1 wherein said extendible and retractable hose is selected from the group consisting of an axially extendible and compressible hose, an accordion-type construction hose, an expandable and collapsible type hose, a hose having a spirally wound wall, a flexible hose having adjacent transverse accordion pleats, and a longitudinally extensible and compressible hose.

11. The system of claim 1 wherein said gas pressure is supplied from a pressurized gas tank.

12. The system of claim 7 wherein said above local atmospheric pressure is supplied from a pressurized gas tank.

13. The system of claim 8 wherein said below local atmospheric pressure is generated by a Venturi tube type device driven from a pressurized gas tank.

14. A vehicle waste transfer system comprising:

one or more tanks capable of holding said waste;

an extendible and retractable hose for transferring said waste, wherein said extendible and retractable hose has two ends, a first end in communication with said one or more tanks, and a second end having an attached nozzle, said extendible and retractable hose extendible so said nozzle is capable of transferring said waste a distance from said vehicle;

wherein said second end is extended in response to gas pressure applied to the inside of said extendible and retractable hose.

15. The system of claim 14 wherein said first end in communication with said one or more tanks is through one or more valves connected between said one or more tanks and said first end.

16. The system of claim 14 wherein said gas pressure is supplied from a tank of compressed air.

17. The system of claim 16 wherein said tank of compressed air has in input port and an output port, said input port in communication with a one-way valve for receiving air, and said output port in communication with a one-way valve for supplying air.

18. The system of claim 17 wherein said source of receiving air is selected from the group consisting of an on-vehicle air compressor, and an external connector for connection to a external source of compressed air.

19. The system of claim 14 further comprising a supporting member attached to said vehicle for supporting said extendible and retractable hose.

20. The system of claim 19 wherein said supporting member is a tube larger in diameter than diameter of said extendible and retractable hose.

21. The system of claim 19 further comprising a storage container for said extendible and retractable hose when in a retracted state.

22. A system for transferring liquid waste comprising:

one or more tanks capable of holding said liquid waste;

an extendible and retractable hose for transferring said liquid waste, wherein said extendible and retractable hose has two ends, a first end for receiving liquid waste from said one or more tanks, and a second end having an attached nozzle, said extendible and retractable hose extendible a distance from said vehicle so said nozzle is capable of transferring said received liquid waste;

wherein said second end is extendible and retractable in response to gas pressure applied to the inside of said extendible and retractable hose.

23. The system of claim 22 further comprising a support device through which said extendible and retractable hose may extend and retract without substantial resistance.

24. The system of claim 22 wherein said extendible and retractable hose when transferring said liquid waste has said second end at an equal or lower elevation than said first end.

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IX. EVIDENCE APPENDIX

Grouping of any Evidence for Claim purposes is for the convenience of reduced duplication and is NOT to be interpreted as the Grouping of Claims for Arguments under 37 C.F.R. § 41.37.

(A) Evidence for Claims 1-24 – Relied Upon

The following item (1) listed below is hereby entered as evidence relied upon by the Examiner as to grounds of rejection for claims 1-24, to be reviewed on appeal. Also listed for each item is where said evidence was entered into the record by the Examiner.

(1) Copy of US Patent Number 6607009 ("Schoellhorn"). This evidence was entered into the record by the Examiner on page 3 paragraph 2. of the Office Action mailed on 01/11/2008, on page 2 paragraph 3 of the Office Action mailed 03/08/2006, on page 2 paragraph 3 of the Office Action mailed 01/21/2005, on IDS sheet included in the Office Action mailed 01/21/2005.

(2) Copy of US Patent Number 6224345 ("Dussault"). This evidence was entered into the record by the Examiner on page 4 paragraph 4. of the Office Action mailed on 01/11/2008.

Copies of all References follows.

US006607009B2

(12) United States Patent

Schoellhorn et al.

(10) Patent No.: US 6,607,009 B2

(45) Date of Patent: Aug. 19, 2003

(54) SEWAGE SYSTEM FOR VEHICLES

(75) Inventors: **Robert A. Schoellhorn**, Coburg, OR (US); **Mark A Bryan**, Eugene, OR (US); **Alan B. Christianson**, Eugene, OR (US); **Gerald R. Lacey**, Springfield, OR (US)

(73) Assignee: **Marathon Coach, Inc.**, Coburg, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 64 days.

(21) Appl. No.: **09/881,293**

(22) Filed: **Jun. 13, 2001**

(65) **Prior Publication Data**

US 2002/0189673 A1 Dec. 19, 2002

(51) **Int. Cl.**[7] **F15B 9/00**; F03C 1/12; F16K 27/12; F16L 3/00

(52) **U.S. Cl.** **137/899**; 137/355.12; 137/355.16; 4/323; 92/34

(58) **Field of Search** 137/899, 355.12, 137/355.16; 138/109, 121, 118.1; 4/323, 661; 92/34

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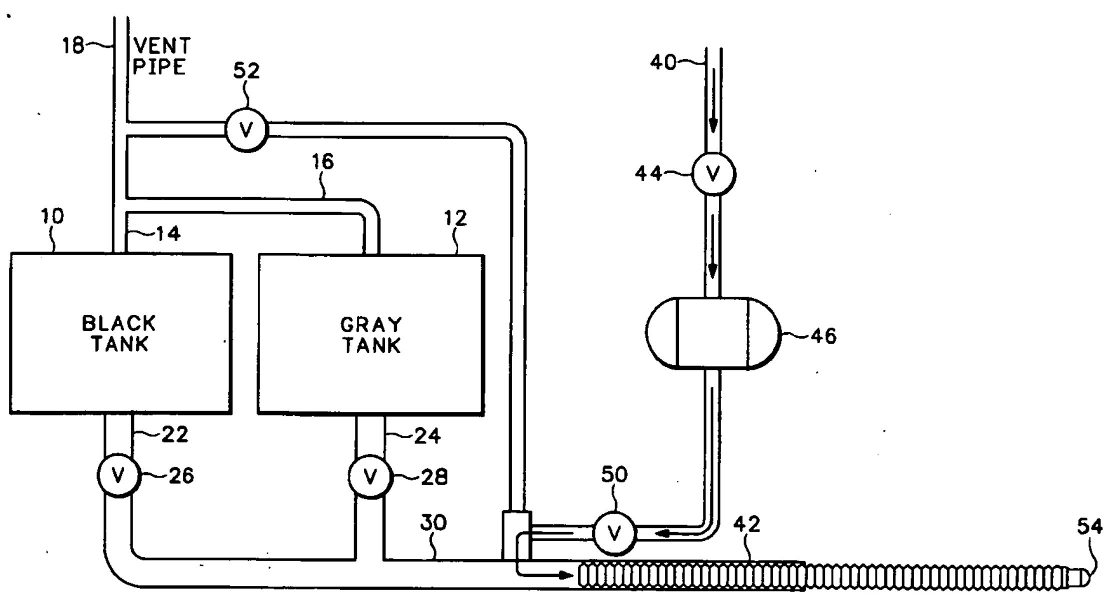
Primary Examiner—A. Michael Chambers

(74) *Attorney, Agent, or Firm*—Chernoff Vilhauer McClung & Stenzel, LLP

(57) **ABSTRACT**

A sewage system for vehicles that includes a waste hose that is extendable and retractable.

30 Claims, 2 Drawing Sheets



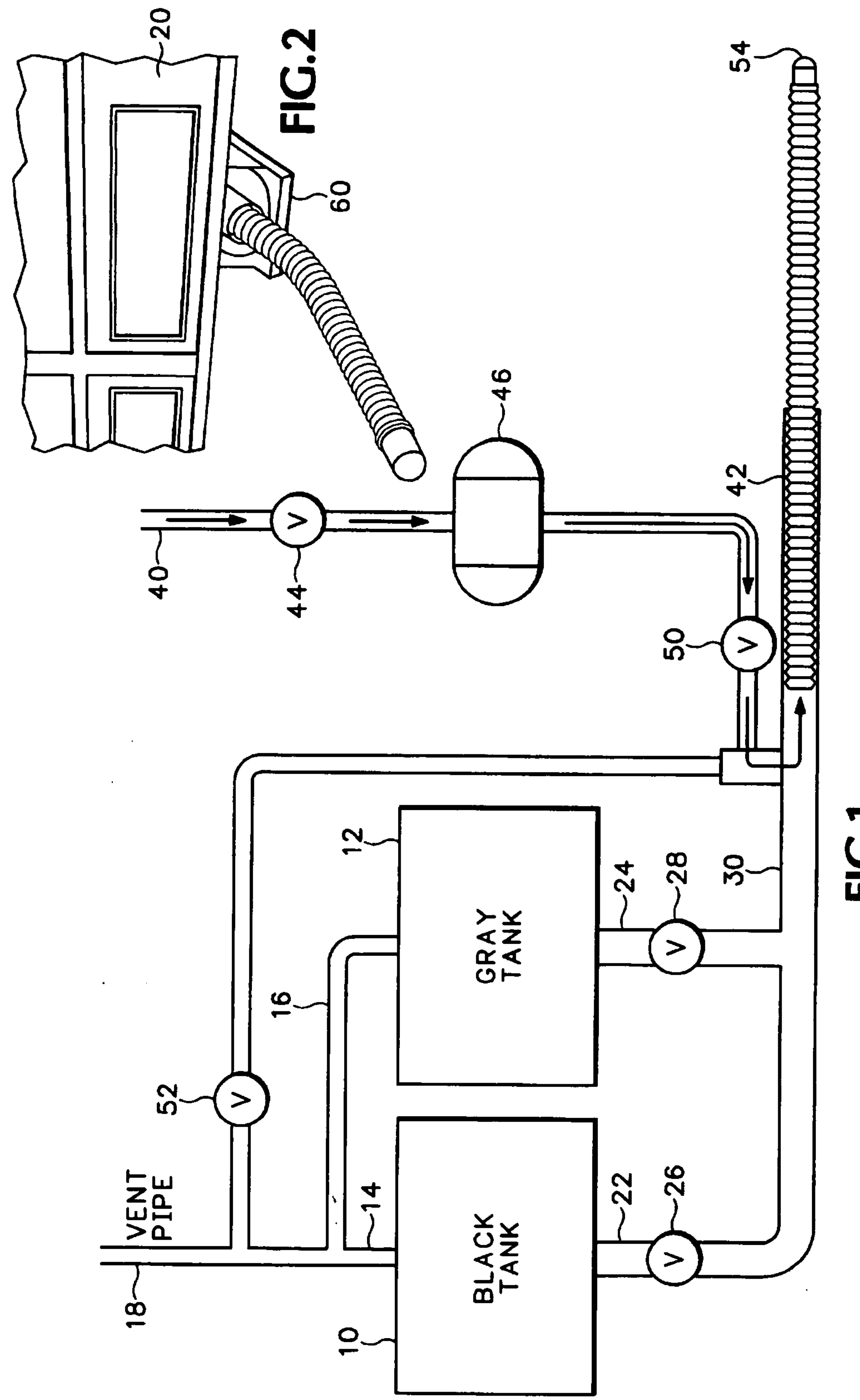

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FIG.2

FIG.1

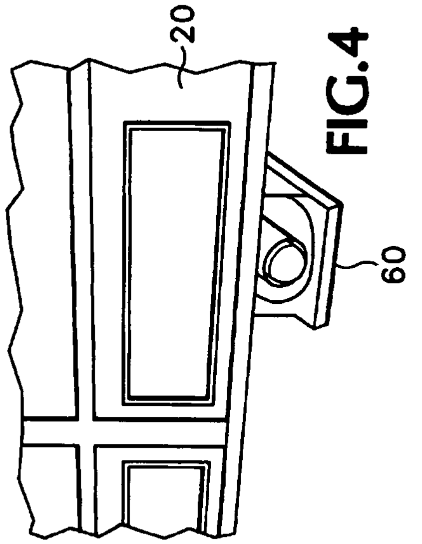
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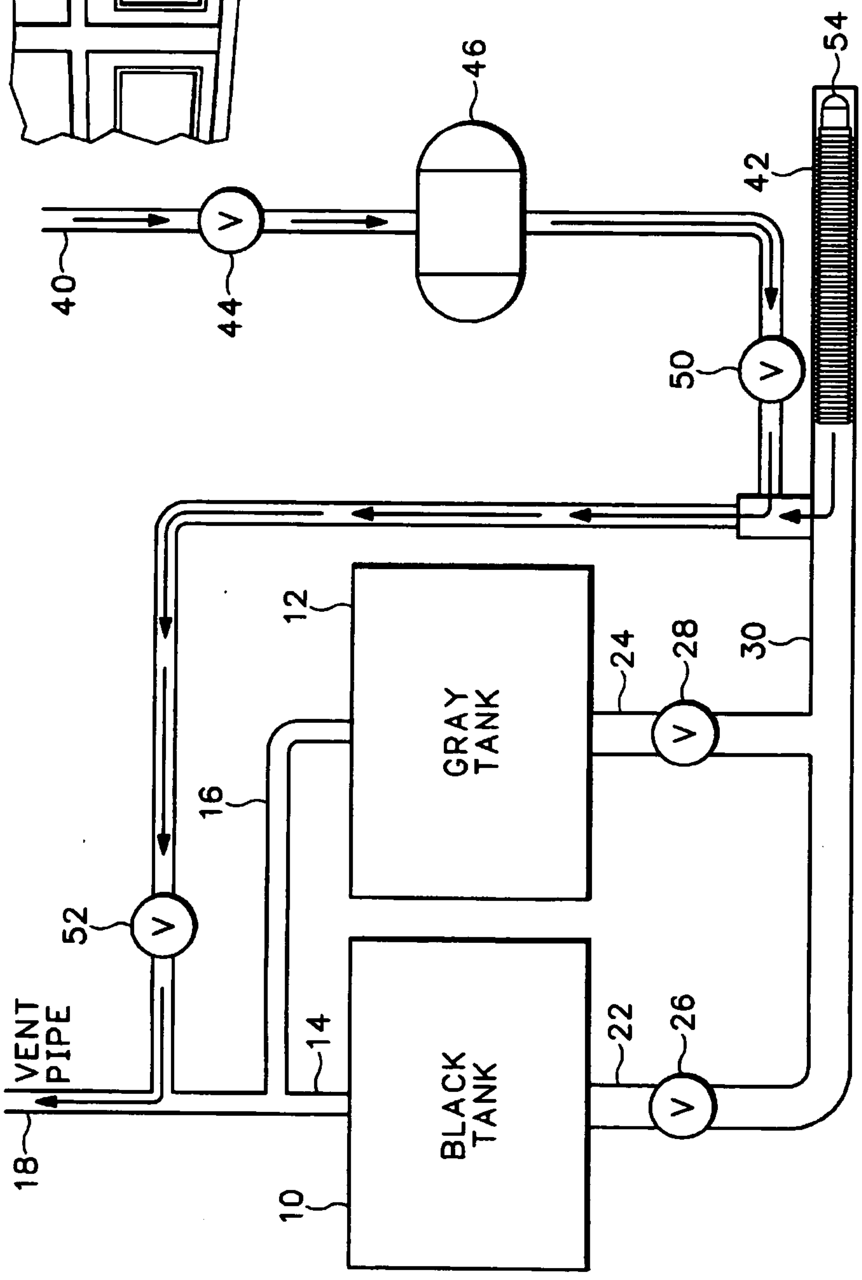
FIG.4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24
28
12
GRAY TANK
16
52
VENT PIPE
18
14
22
26
BLACK TANK
10

FIG.3

SEWAGE SYSTEM FOR VEHICLES

BACKGROUND OF THE INVENTION

The present invention relates to a sewage system for a vehicle.

Many types of vehicles, such as recreational vehicles, travel trailers, fifth wheelers, buses, trucks, and the like have self-contained fluid systems, sinks, washing facilities and/or bathrooms. Each of these vehicles and others will be collectively referred to herein as "recreational vehicles" or "RVs". Such RVs include systems which store sewage and waste water until those materials can be properly disposed of. Typically, RVs generally utilize similar means of conducting waste to external storage tanks, dumps, or processing systems, such as those which are used in RV parks, truck stops, bus stops, and the like. Conventional RVs generally have two holding tanks, a sewage tanks (e.g., black tank) for receiving fluid sewage from the toilet system, and a grey water tank for receiving waste water, such as from the kitchen, bathroom sinks, and shower. These two holding tanks are interconnected to form a single liquid conduit drain line or drain pipe. RVs generally have an accessible external cabinet or storage facility which stores a length of flexible sewage discharge hose or other conduit. This discharge hose or other conduit may be manually connected to a fitting on the outlet stub of the drain pipe. The other end of the hose or other conduit is then extended to a dump fitting. Similarly, when the RV is preparing to move on, it is also necessary to handle the hose or other conduit, and flush the waste from it before storing it. These processes, i.e., dumping the waste from the holding tank into the inlet receptacle of the RV dump station and disconnecting and storing the hose or other conduit, are the messiest and most dreaded aspects of using an RV.

Besides the mess of dealing with the liquid waste problem, the predominate problem with the traditional sewage hose or other conduit system, is that the RV user must get on his or her knees and reach beneath the RV to attach the sewage hose or other conduit to the outlet pipe of the conduit beneath the RV. Consequently, there have been numerous devices which have been developed to increase the ease and/or reduce the clumsiness of attaching and detaching RV sewage hoses or other conduits. Many of such systems include flexible discharge hoses that are stored in a conduit extension member beneath the RV, and are telescopically moved therefrom when it is desired to secure the hose to a dump site. While these systems have their merits, these devices are stored permanently beneath the RV, and they still generally require the RV user to get on his or her knees to reach beneath the RV to access the sewage hose.

Mercer, U.S. Pat. No. 5,023,959, discloses a system for extending and retracting the waste hose for a waste disposal system that is typically found on recreational vehicles. The disposal system includes a power driven hose extender for extending the collapsible hose from its collapsed mode stored on-board the recreational vehicle to its extended configuration which it is used for dumping waste from an RV holding tank into an inlet of an RV waste dump station. In particular, a hose driver is used to axially displace threaded shafts, wherein an external collar engages around the accordion hose, which has a continuous helical rib.

Mercer, U.S. Pat. No. 4,133,347, discloses a waste evacuation attachment for a recreational vehicle that includes a rigid cylindrical housing readily mountable to the existing fitting of a sewage discharge outlet of the recreational vehicle. A telescoping hose is contained within the housing and has a fitting on the extendable end to adapt the hose to waste receiving receptacles. The extension and retraction of the hose is by extending and retracting the hose within the housing. Foreman, U.S. Pat. No. 4,854,349, likewise discloses telescoping hose contained within a housing.

Hanemaayer, U.S. Pat. No. 5,653,262, discloses an axially extendable flexible hose connected to a waste outlet of a tank. An elongated tubular housing is provided within which the flexible hose extends such that the hose can be stored in the housing and also drawn outwardly of the distal end of the housing toward a waste receptacle. The housing has an articulated connection at a proximate end thereof adjacent the waste outlet. The extension and retraction of the hose is by extending and retracting the articulated hose within the housing.

Cook, U.S. Pat. No. 4,223,702, discloses a telescoping drain line for connecting recreational vehicles to a sewage system. The flexible hose extends through the telescoping pipe sections.

Feliz, U.S. Pat. No. 3,811,462; Boomgaarden, U.S. Pat. No. 5,244,003; Leech, U.S. Pat. No. 5,904,183; and Sargent et al., U.S. Pat. No. 4,779,650, likewise disclose telescoping tubular arrangements.

While many of the aforementioned systems provide telescoping tubular arrangements, they still require a substantial amount of effort on the part of the user to discharge the sewage.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exemplary schematic of a sewage system for a vehicle for extending a waste hose.

FIG. 2 is a side view of a portion of the vehicle of FIG. 1 showing the waste hose in the extended position.

FIG. 3 is an exemplary schematic of the sewage system for the vehicle of FIG. 1 for retracting the waste hose.

FIG. 4 is a side view of a portion of the vehicle of FIG. 3 showing the waste hose in the retracted position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, an exemplary waste system for a RV of the present invention may include a black tank **10** for holding toilet sewage and a grey tank **12** for holding other waste water, such as for example, the sink or the shower. The black tank and the grey tank **12** may be replaced by a single storage container, if desired. The black tank **10** and the grey tank **12** are interconnected by pipes **14** and **16** to a vent pipe **18**. The vent pipe **18** is preferably vented to the exterior of the recreational vehicle **20** (see FIG. 2) which provides for air flow into and out of the waste system. The black tank **10** may be drained through a drain pipe **22** when a black waste valve **26** is opened. Conversely, when the black waste valve **26** is closed the waste in the black tank **10** is not drained. Similarly, the grey tank **12** may be drained through a drain pipe **24** when a grey waste valve **28** is opened. Conversely, when the grey waste valve **28** is closed the waste in the grey tank **12** is not drained. The waste from the grey tank **12** and black tank **10** are preferably joined into a single drain pipe **30** for eventual discharge from the RV into a suitable receptacle. Multiple drain pipes for discharge of materials from the RV may be used, if desired.

After consideration of the typical recreational vehicle, the present inventors came to the realization that many recreational vehicles include an internal compressor which pro-

vides pressurized air (or other gas) that may be used by the waste system. The waste system may use the pressurized air to provide automatic extension and retraction of the waste hose **42**. Using an existing pressurized air source reduces the expense of an automated extension and retraction of the waste hose **42**. The automatic extension alleviates the need for the user to bend down under the RV or otherwise manually extend and retract the waste hose **42**. The waste system preferably includes an intake **40** that provides air pressure from the recreational vehicle **20**. The air pressure within the intake may be provided from the recreational vehicle **20** powered when the engine is running or otherwise a compressor within the recreational vehicle **20**. An intake check valve **44** is preferably a "one-way" valve that substantially only permits air flow in a single direction, as indicated by the arrows. In this manner, the air flow will not flow back to the pressurized air source. An air tank **46** is preferably included that stores additional compressed air, such as a 7 gallon tank, so that sufficient air pressure is obtained without having to increase the capacity of the air compressor. It is to be understood that valve, as used herein, refers to any mechanism that is suitable to control the flow, stop the flow, restrict the flow or otherwise, of materials through a tubular member.

When the user desires to extend the waste hose **42**, a check valve **50** is opened which permits air pressure to flow through the check valve **50** and into the drain pipe **30**. A vent check valve **52** is preferably closed to primarily restrict the air flow through the drain pipe **30**. Likewise, preferably the black waste valve **26** and the grey waste valve **28** are closed. Accordingly, substantially all the air flow will be acting upon the waste hose **42** which is preferably slidably engaged with the waste system. More preferably the waste hose **42** (or a majority thereof) is freely slidably engaged with the waste system over a majority of its extension. Moreover, the waste hose **42** may rotatably extend or move based upon other mechanisms in such a manner as to extend from the vehicle. The pressure exerted on the end portion of the waste hose **42**, capped by a detachably engageable cover **54**, will cause the waste hose **42** to slide outwardly from the recreational vehicle **20**, as illustrated in FIG. **2**. In this manner, by simply opening the valve **50** the waste hose **42** may be slidably extended in a manner that is free from the user having to manually pull or otherwise extend the waste hose. After extending the waste hose **42** the cover **54** is removed and the waste hose **42** is interconnected with the suitable waste receptacle. Other air pressure techniques may likewise be used to extend the waste hose **42**, such as for example, air pressure against the interior end **54** of the waste hose **42** as opposed to air pressure against the cover **54**, an air pressure operated rotational mechanism that extends/retracts the waste hose **42**, and a hydraulics based pressure extension/retraction mechanism. Moreover, if desired the air pressure mechanism may be replaced by an electrical extension/retraction system or other type of extension/retraction system that automatically extends and/or retracts the waste hose **42**. Thereafter the black tank and/or the grey tank may be emptied into the receptacle by selectively opening the black waste valve **26** and/or the grey waste valve **28**, respectively. The waste hose **42** may be, for example, articulated, non-articulated, extendable lengthwise, non-extendable lengthwise, substantially non-compressible, and/or substantially compressible. Further, the waste hose **42** may be any type of tubular member having any cross sectional profile(s) suitable to pass liquids through.

For example, the waste system may be used to extend the waste hose **42** as follows. Initially a button, a lever, or other user initiation of the waste system is performed. The vent check valve **52** is closed if not already closed, the black waste valve **26** is closed if not already closed, the grey waste valve **28** is closed if not already closed, and the check valve **50** is opened if not already opened. The air from the air intake **40** and/or air from the air tank **46** provides air pressure against the waste hose **42** (or other mechanism) which causes the waste hose **42** to slidably extend outwardly from the vehicle **20**. The user then removes the cover **54** and engages the waste hose **42** with the receptacle.

Referring to FIG. **3**, the waste system may retract the waste hose **42** as follows. The user disengages the waste hose **42** from the receptacle and replaces the cover **54**. The user then presses a button, a lever, or other user initiation of the waste system if performed. The vent check valve **52** is opened if not already opened, the black waste valve **26** is closed if not already closed, the grey waste valve **28** is closed if not already closed, and the check valve **50** is opened if not already opened. The air from the air intake **40** and/or air from the air tank **46** provides air pressure that passes through the vent check valve **52** which creates a vacuum within the waste hose **42** which causes the waste hose **42** to retract inwardly toward the vehicle **20**, as illustrated in FIG. **4**. After completing usage of the waste system, the vent check valve **52**, the check valve **50**, the black waste valve **26**, and/or the grey waste valve **28** are preferably closed.

After further consideration, the present inventors determined that having a stationary opening under the recreational vehicle **20** for the waste hose **42** permits the waste hose **42** to be inadvertently damaged while traveling. Moreover, having a manually removable cover for the stationary opening, while advantageous, still requires the user to manually remove the cover. Referring to FIGS. **2** and **4**, preferably the waste hose **42** is supported by a movable support **60**. In a closed position, the support **60** rotates, raises, or otherwise moves such that the waste hose **42** is not free to extend. Also, the support **60** moves the end of the waste hose **42** to a position that is protected from the exterior elements when not in use. Moreover, preferably upon moving the support **60** to an opened position, the end of the hose is directed at an acute angular relationship, such as for example 10–45 degrees, with respect to the ground. This angular relationship assists in directing the waste hose **42** across the ground in a manner that facilitates extension of the waste hose **42**.

All references discussed herein are hereby incorporated by reference.

The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

What is claimed is:

1. A liquid water materials system for a vehicle comprising:

(a) a storage container for liquid waste materials;

(b) an elongate tubular member through which said waste materials may flow, wherein said elongate tubular member has an end;

(c) said end of said elongate tubular member is movable from a first position to a second position, wherein said end when in said second position is further distant from said vehicle than said end in said first position; and

(d) wherein said movement of said end is in response to air pressure exerted within said tubular member.

2. The system of claim 1 wherein said storage container includes a first container and a second container.

3. The system of claim 1 wherein said first container stores toilet sewage and said second container stores shower waste water.

4. The system of claim 1 wherein said storage container is vented to the exterior of said vehicle.

5. The system of claim 3 further comprising a first valve interconnected to the output of said first container and a second valve interconnected to the output of said second container.

6. The system of claim 1 further comprising an air tank that provides pressurized air for said movement.

7. The system of claim 6 further comprising first check valve interconnected to the output of said air tank and a second check valve interconnected to the input of said air tank.

8. The system of claim 1 further comprising a valve that selectively causes said movement of said end.

9. The system of claim 1 further comprising said end of said elongate tubular member being movable from said second position to said first position, wherein said end when in said second position is further distant from said vehicle than said end in said first position, wherein said movement of said end is in response to air pressure.

10. The system of claim 1 further comprising said end of said elongate tubular member being movable from said second position to said first position, wherein said end when in said second position is further distant from said vehicle than said end in said first position, wherein said movement of said end is in response to air pressure.

11. A liquid water materials system for a vehicle comprising:

(a) a storage container for liquid waste materials;

(b) an elongate tubular member through which said waste materials may flow, wherein said elongate tubular member has an end;

(c) said end of said elongate tubular member is movable from a first position to a second position, wherein said end when in said second position is further distant from said vehicle than said end in said first position; and

(d) wherein said movement of said end is slidably engaged with said vehicle free from engagement with external ribs of said tubular member.

12. The system of claim 11 wherein said storage container includes a first container and a second container.

13. The system of claim 12 wherein said first container stores toilet sewage and said second container stores shower waste water.

14. The system of claim 11 wherein said storage container is vented to the exterior of said vehicle.

15. The system of claim 13 further comprising a first valve interconnected to the output of said first container and a second valve interconnected to the output of said second container.

16. The system of claim 11 further comprising an air tank that provides pressurized air for said movement.

17. The system of claim 16 further comprising first check valve interconnected to the output of said air tank and a second check valve interconnected to the input of said air tank.

18. The system of claim 11 further comprising a valve that selectively causes said movement of said end.

19. The system of claim 11 further comprising said end of said elongate tubular member being movable from said second position to said first position, wherein said end when in said second position is further distant from said vehicle than said end in said first position, wherein said movement of said end is slidably engaged with said vehicle.

20. The system of claim 11 wherein said movement is in response to air pressure.

21. A liquid water materials system for a vehicle comprising:

(a) a storage container for liquid waste materials;

(b) an elongate tubular member through which said waste materials may flow, wherein said elongate tubular member has an end;

(c) said end of said elongate tubular member is movable from a first position to a second position, wherein said end when in said second position is further distant from said vehicle than said end in said first position; and

(d) wherein said movement of a majority of said tubular member is slidably engaged with said vehicle over a majority of the distance between said first position and said second position.

22. The system of claim 21 wherein said slidable engagement is freely slidably engaged.

23. The system of claim 21 wherein said storage container includes a first container and a second container.

24. The system of claim 23 wherein said first container stores toilet sewage and said second container stores shower waste water.

25. The system of claim 21 wherein said storage container is vented to the exterior of said vehicle.

26. The system of claim 21 further comprising a first valve interconnected to the output of said first container and a second valve interconnected to the output of said second container.

27. The system of claim 21 further comprising an air tank that provides pressurized air for said movement.

28. The system of claim 27 further comprising first check valve interconnected to the output of said air tank and a second check valve interconnected to the input of said air tank.

29. The system of claim 21 further comprising a valve that selectively causes said movement of said end.

30. A liquid water materials system for a vehicle comprising:

(a) a storage container for liquid waste materials;

(b) an elongate tubular member through which said waste materials may flow, wherein said elongate tubular member has an end;

(c) said end of said elongate tubular member is movable from a first position to a second position, wherein said end when in said second position is further distant from said vehicle than said end in said first position; and

(d) wherein said end of said elongate tubular member is maintained in a first elevation prior to movement from said first position to said second position, wherein said end of said tubular member is maintained in a second elevation prior to movement from said first elevation to said second elevation, wherein said first elevation is lower than said second elevation, wherein said end of said tubular member is moved from said second elevation to said first elevation prior to moving from said first position to said second position.

* * * * *

US006224345B1

(12) **United States Patent**
Dussault

(10) **Patent No.: US 6,224,345 B1**
(45) **Date of Patent: May 1, 2001**

(54) **PRESSURE/VACUUM GENERATOR**

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(73) Assignee: **Bijur Lubrication Corporation**, Bennington, VT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/273,986**

(22) Filed: **Mar. 22, 1999**

(51) **Int. Cl.**[7] **F04F 1/06**; F04F 5/48

(52) **U.S. Cl.** **417/138**; 417/182; 417/182.5

(58) **Field of Search** 417/138, 182, 417/182.5, 185

(56) **References Cited**

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3,981,319	*	9/1976	Holt	137/211
4,770,610		9/1988	Breckner	417/12
4,828,461	*	5/1989	Laempe	417/132
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5,451,144		9/1995	French	417/132
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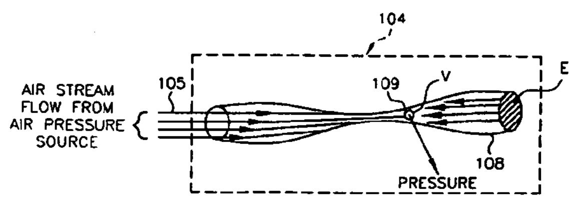
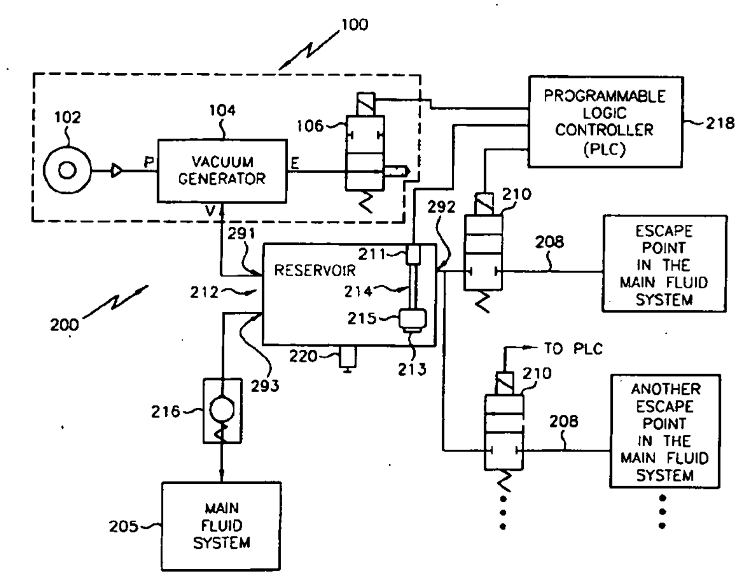
Primary Examiner—Timothy S. Thorpe
Assistant Examiner—Michael K. Gray
(74) *Attorney, Agent, or Firm*—Caesar, Rivise, Bernstein, Cohen & Pokotilow, Ltd.

(57) **ABSTRACT**

A pressure/vacuum generator is established by coupling the pressure port of a vacuum generator to an air pressure source while coupling a valve in fluid communication with the exhaust port of the vacuum generator. When the valve is in a normally open condition (i.e, the exhaust vented to atmosphere), the vacuum port of the pressure/vacuum generator generates a vacuum. When the valve is closed, thereby closing off the exhaust port, the vacuum port becomes a pressure port. Thus, this pressure/vacuum generator can be used in any number of fluid (liquid and gas) systems (e.g., fluid recovery system, fluid transfer system, etc.)that require both a pressure source and a vacuum source while using a minimum number of components.

20 Claims, 9 Drawing Sheets





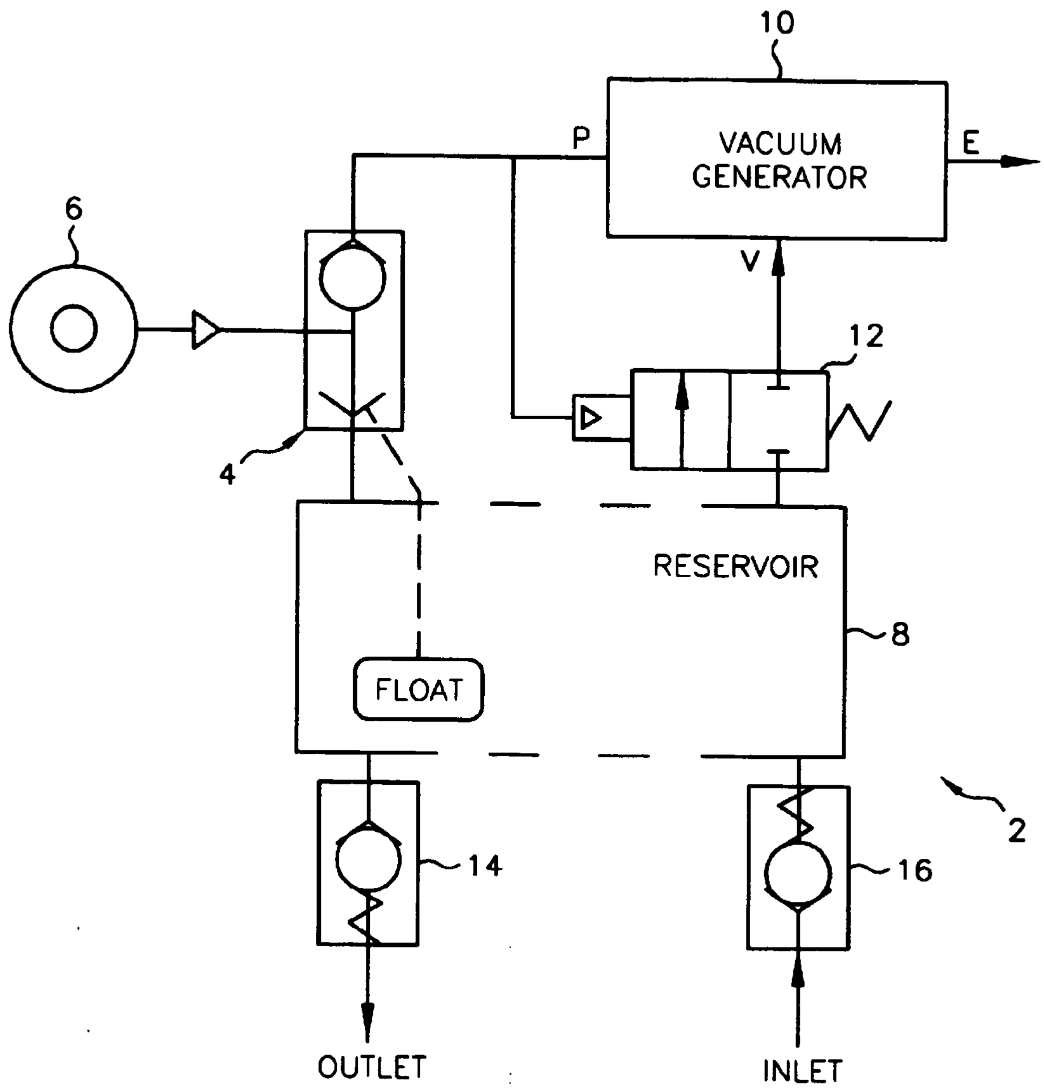


FIG. 1
(Prior Art)

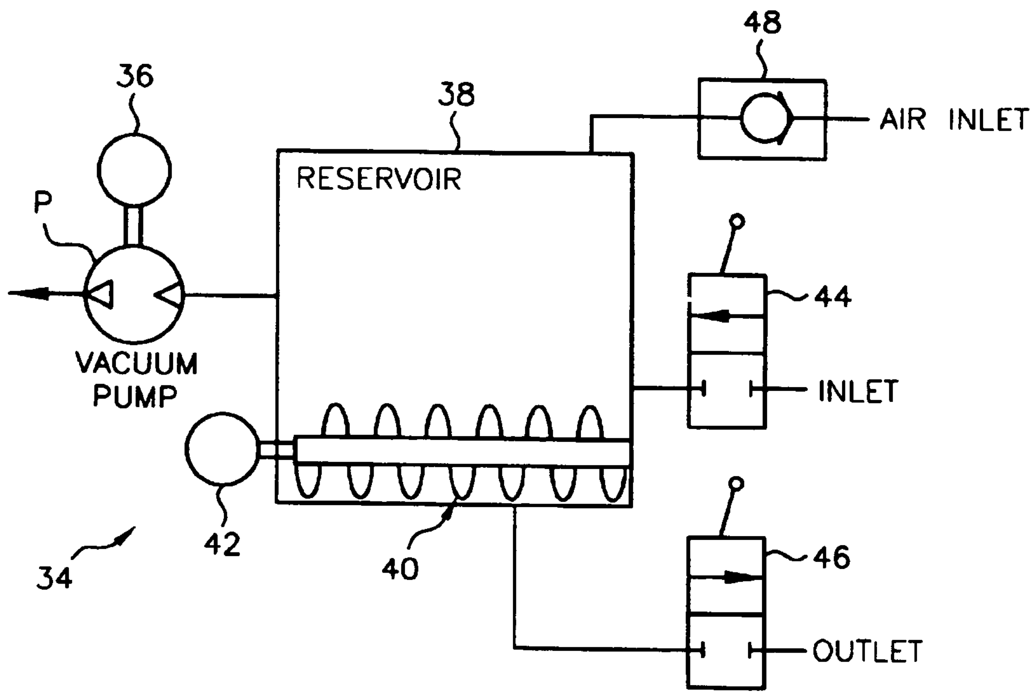


FIG. 2
(Prior Art)

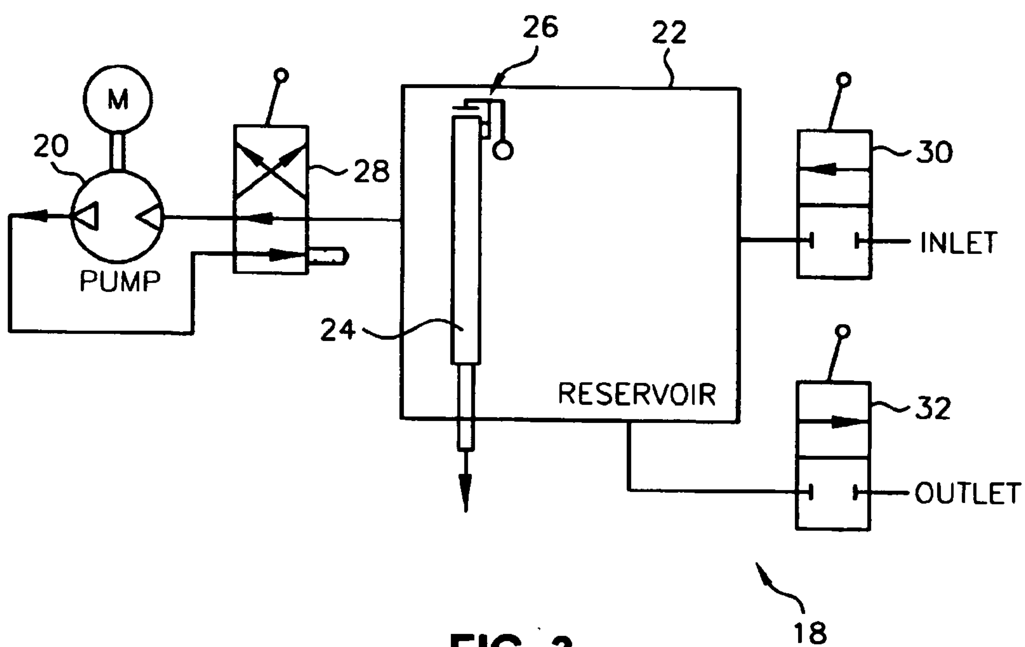


FIG. 3
(Prior Art)

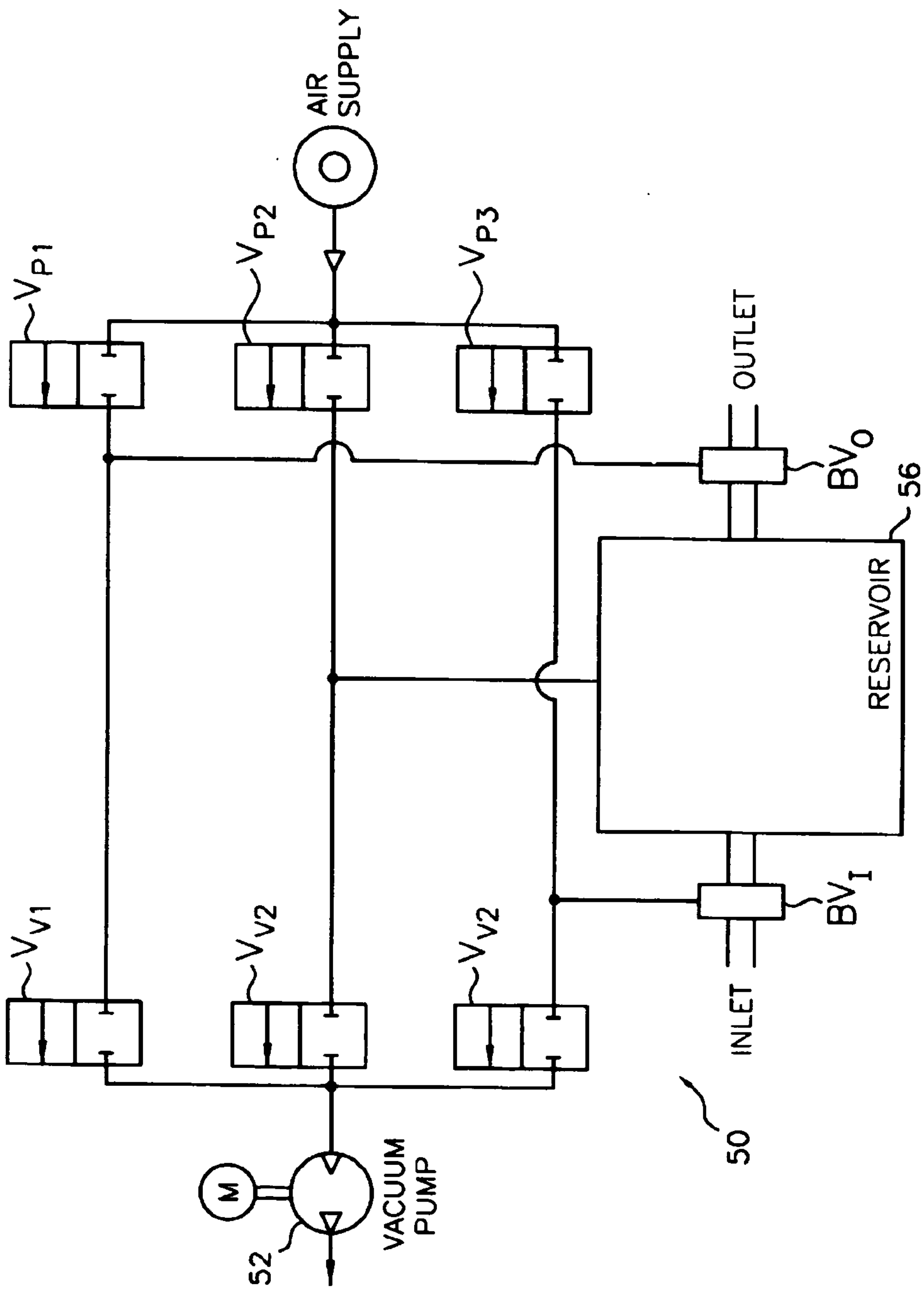


FIG. 4
(Prior Art)

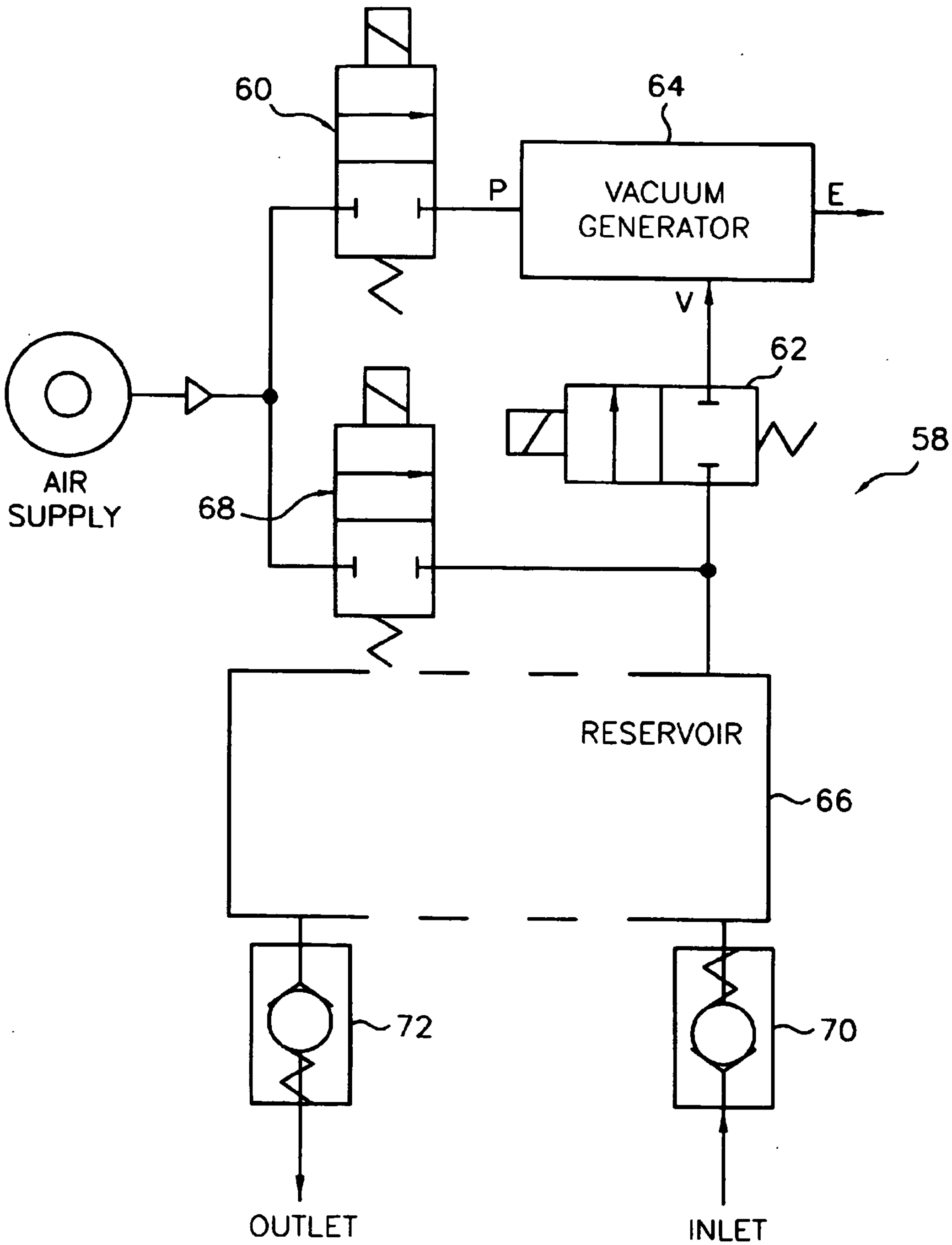


FIG. 5
(Prior Art)

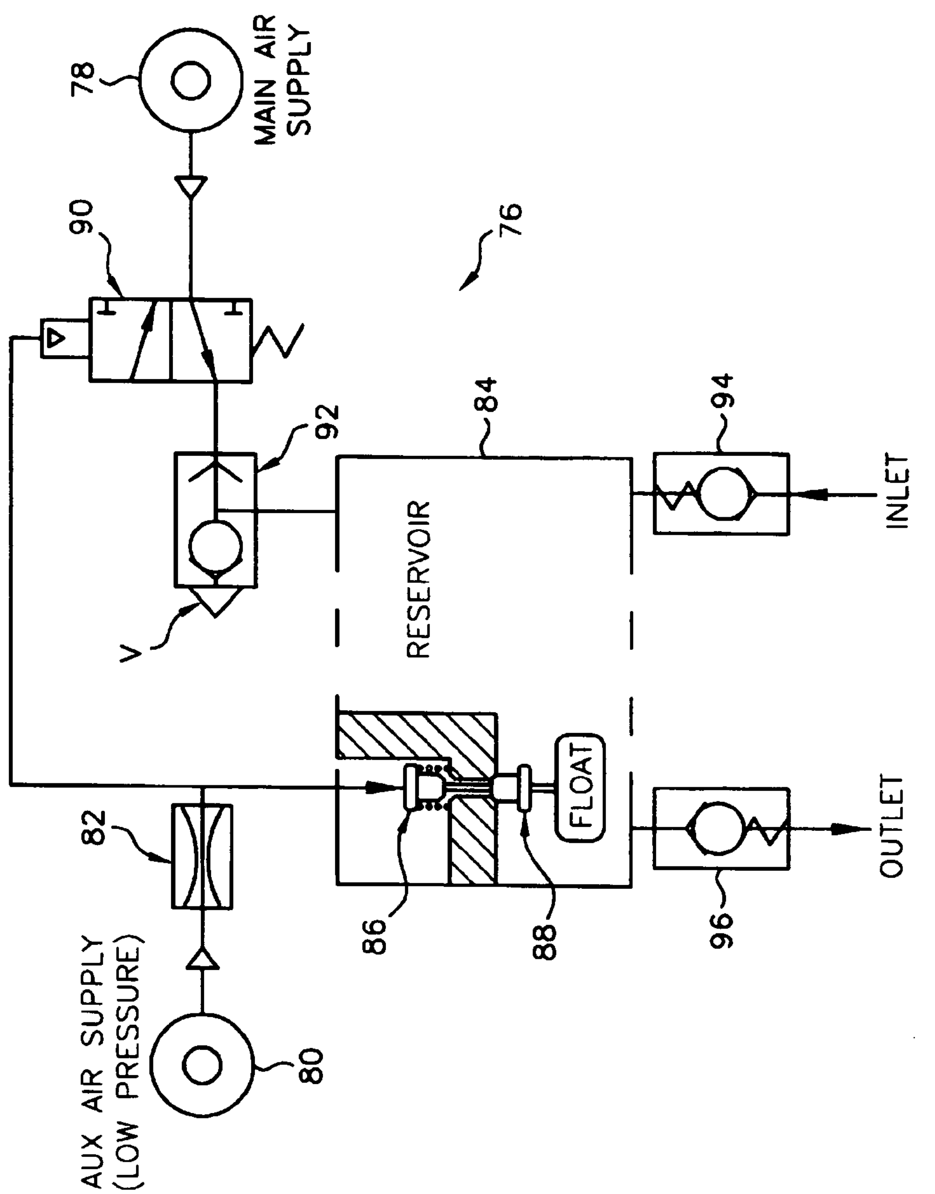


FIG. 6
(Prior Art)

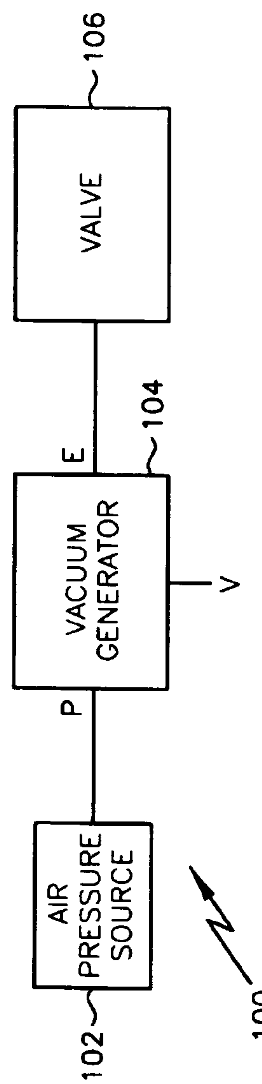


FIG. 7

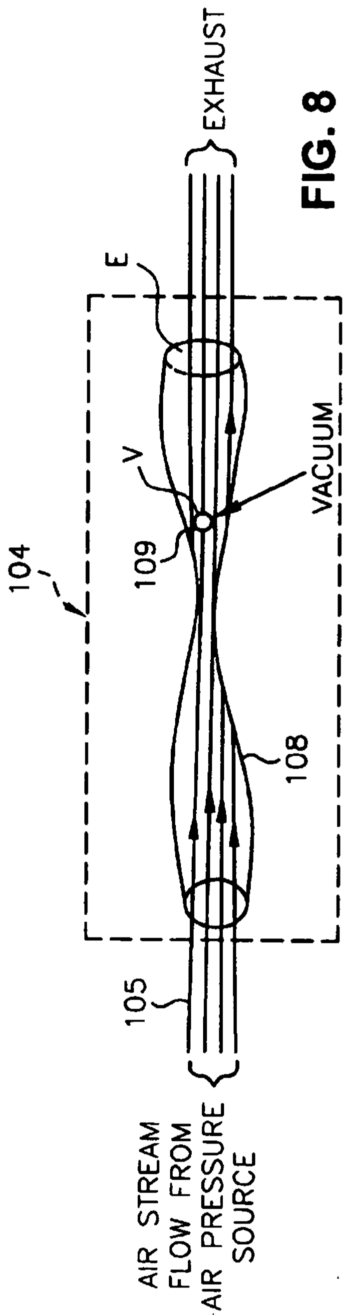


FIG. 8

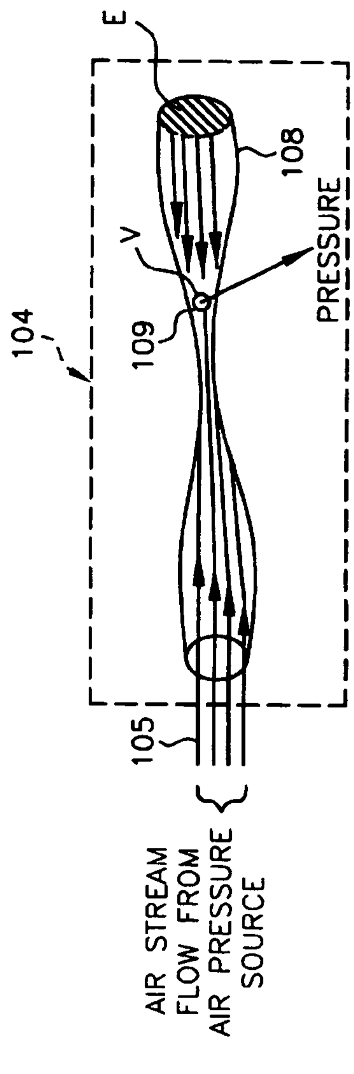


FIG. 9

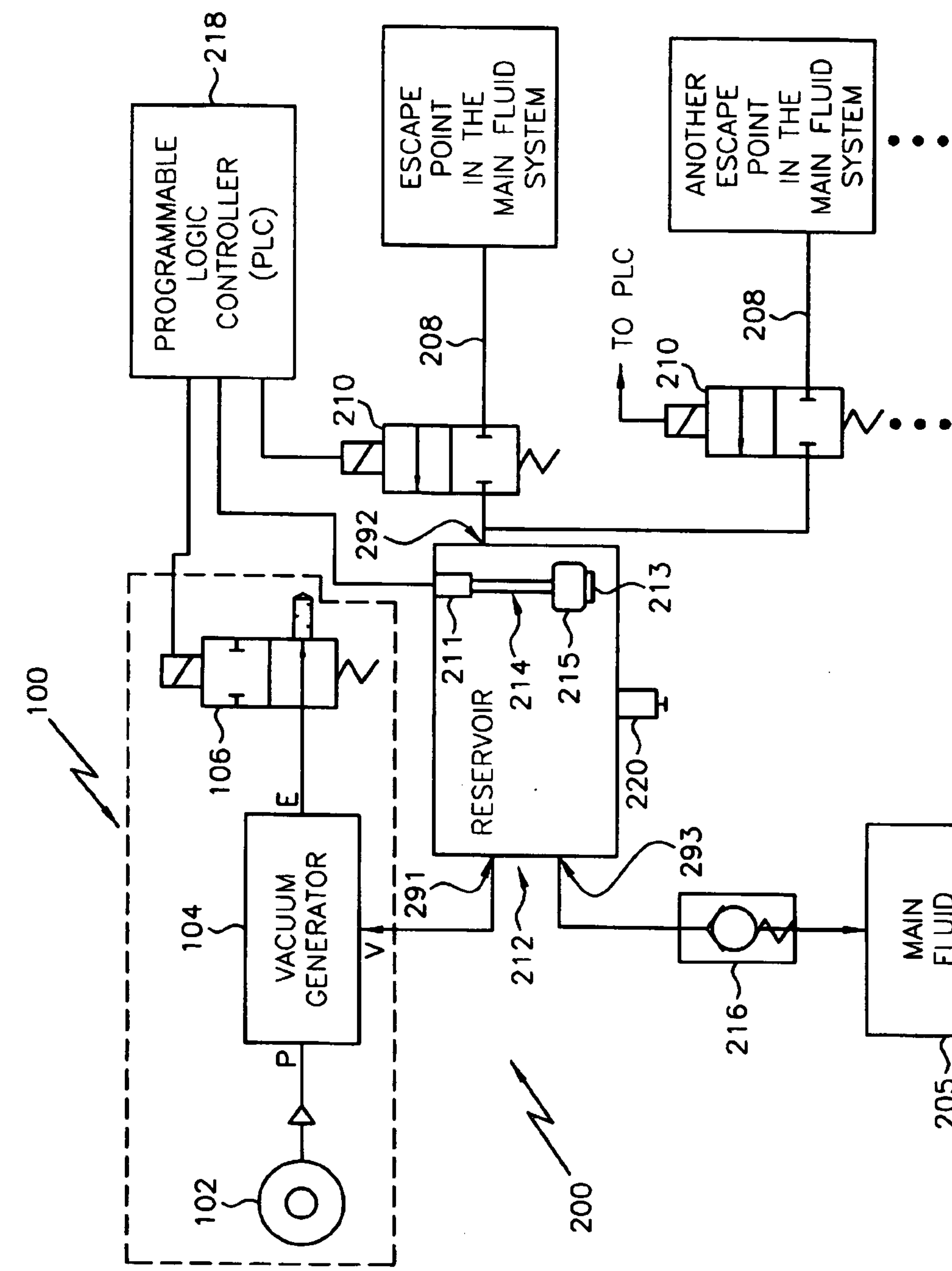

PROGRAMMABLE LOGIC CONTROLLER (PLC)
218
ESCAPE POINT IN THE MAIN FLUID SYSTEM
ANOTHER ESCAPE POINT IN THE MAIN FLUID SYSTEM
TO PLC
208
210
292
213
211
214
215
RESERVOIR
220
293
291
212
100
106
E
VACUUM GENERATOR
104
V
P
102
200
216
MAIN FLUID SYSTEM
205

FIG. 10

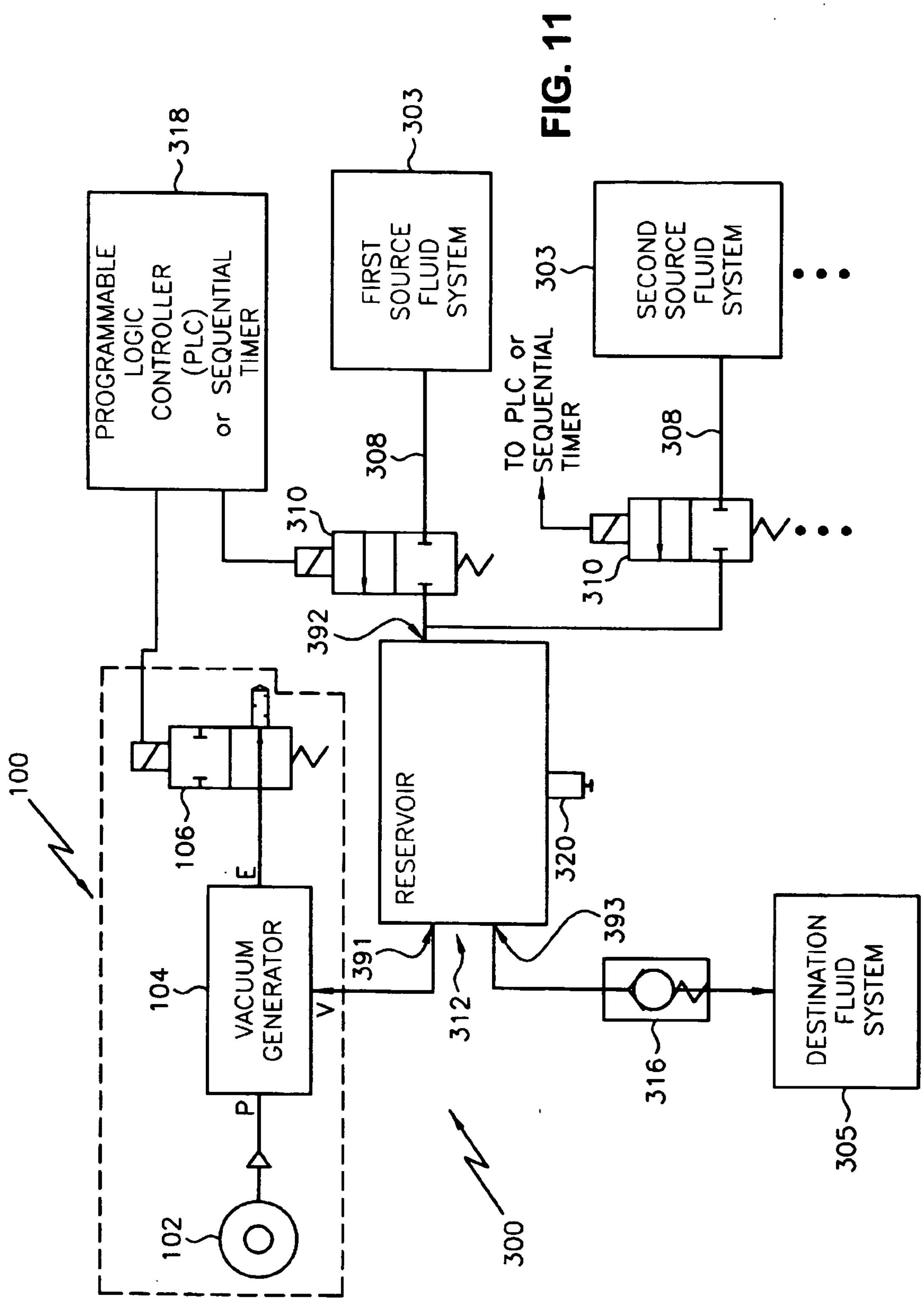

PROGRAMMABLE LOGIC CONTROLLER (PLC) or SEQUENTIAL TIMER
318
FIRST SOURCE FLUID SYSTEM
303
SECOND SOURCE FLUID SYSTEM
303
TO PLC or SEQUENTIAL TIMER
308
308
310
310
392
RESERVOIR
320
393
391
312
316
DESTINATION FLUID SYSTEM
305
300
VACUUM GENERATOR
104
E
V
P
106
102
100

FIG. 11

PRESSURE/VACUUM GENERATOR

FIELD OF THE INVENTION

The invention pertains to the field of fluid systems, and more particularly, to systems that require the use of both a pressure source and a vacuum source.

BACKGROUND OF INVENTION

In many fluid systems, there is a need to have both a pressure source (e.g., a pump) as well as a vacuum source (e.g., vacuum pump, vacuum generator, etc.). For example, in fluid recovery systems or fluid transfer systems, there is a need to collect a fluid from a first location (e.g., a main fluid system, a first fluid system, a fluid collection point) and move the fluid into a reservoir and then to evacuate the fluid from that reservoir either back to the main fluid system (i.e., a recovery system) or to a second fluid system (i.e., a transfer system). To accomplish this, a vacuum source draws the fluid into the reservoir and then a pressure source drives it out of the reservoir.

The following U.S. patents are various types of fluid systems using pressure sources and vacuum sources.

U.S. Pat. No. 2,400,651 (Marsh) discloses a liquid elevating system. A summary of the Marsh system **2** is shown in FIG. **1**. The Marsh system **2** uses a shuttle valve **4** between an air supply **6**, a reservoir **8** and a pressure inlet (P) of a vacuum generator **10**, as well as an air-operated valve **12** between the reservoir **8** and a vacuum inlet (V) of the vacuum generator **10**. A reservoir inlet check valve **16** and a reservoir outlet check valve **14** are also used. A float mechanism **20** inside the reservoir **8** controls the shuttle valve **4**.

U.S. Pat. No. 2,522,077 (Wahl) discloses a tank truck. A summary of the pumping system **34** used in the Wahl truck is shown in FIG. **2**. The pumping system **34** uses a pump (P, driven by a motor **36**) to draw a vacuum on a reservoir **38** to pull liquid in, and a mechanical screw **40** coupled to another motor **42** to pump it out. Manually-operated input **44** and output **46** valves are also used, as well as an air inlet check valve **48**. The system **34** is manually-operated.

U.S. Pat. No. 2,664,911 (Thompson) discloses a portable vacuum and pressure liquid tank truck. A summary of the pumping system **18** of the truck is shown in FIG. **3**. The pumping system **18** uses a pump **20** (driven by a motor, M) to draw a vacuum or pressurize a reservoir **22**; a separator **24** with a float valve **26** keeps fluid from getting into the pump **20**. The pump **20** action (vacuum, or pressure) is based on the position of a valve **28** that is manually controlled. Manually-operated input **30** and output **32** valves are also used.

U.S. Pat. No. 3,315,611 (Thompson) discloses a portable vacuum and pressure liquid tank truck, and uses a pumping system similar to the pumping system disclosed in U.S. Pat. No. 2,664,911 (Thompson) but adds an air bleeder to the system. The bleeder line draws air into the tank along with the liquid during the vacuum stage, thus eliminating foam. During the pressure stage, pressurized air is mixed with the liquid in the tank, making it easier to pump.

U.S. Pat. No. 4,770,610 (Breckner) discloses a frail material slurry pump system **50**. A summary of the Breckner system **50** is shown in FIG. **4**. This system **50** uses a vacuum pump **52** (driven by a motor M) and combination valving (V_{P1}–V_{P3}, V_{V1}–V_{V3}, BV_I and BV_O) to pull a vacuum on a reservoir **56** and uses a compressor (not shown, but forms a part of the air supply) with the combination valving (V_{P1}–V_{P3}, V_{V1}–V_{V3}, BV_I and BV_O) to pressurize the reservoir **56**. The BV_I and BV_O valves are a bladder type to prevent damage to the frail material being pumped. This combination valving (V_{P1}–V_{P3} with V_{V1}–V_{V3}) controls the inlet BV_I and outlet BV_O bladder valves of the reservoir **56**.

U.S. Pat. No. 4,828,461 (Laempe) discloses an apparatus for metering flowable materials in sand core making machines. A summary of the pumping system **58** used therein is shown in FIG. **5**. The pumping system **58** works in a similar manner to the Marsh system **2** (FIG. **1**) but includes two shut-off valves, **60** and **62**, going into a vacuum generator **64**, whereby the shut-off valve **60** is coupled to the pressure port (P) of the vacuum generator **64** and the shut-off valve **62** is coupled to the vacuum port (V) of the vacuum generator **64**. In order to pressurize a reservoir **66**, the pumping system **58** uses a third shutoff valve **68** (for dividing the air supply, while closing the upper shut-off valve **60**). Reservoir inlet **70** and outlet **72** check valves are also used with the reservoir **66**.

U.S. Pat. No. 5,451,144 (French) discloses an air-operated pump system **76**. A summary of this pump system **76** is shown in FIG. **6**. The system **76** primarily uses gravity to draw liquid in, whereby a vaccum (V) is available as an option to assist gravity. The system **76** utilizes two sources of air pressure: a main air supply **78** and an auxiliary air supply **80**, the latter of which is fed to a reservoir **84** via flow restrictor **82**. Two poppet valves **86** and **88** are used. An air-operated three-way valve **90** is controlled by the poppet valves **86** and **88**. A quick-exhaust valve **92** is coupled between the three-way valve **90** and the reservoir **84**. Inlet **94** and outlet **96** check valves are also used with the reservoir **84**.

However, none of these references teach or suggest controlling the exhaust port of a vacuum generator for creating both a pressure source and a vacuum source.

OBJECTS OF THE INVENTION

Accordingly, it is the general object of this invention to provide an invention that overcomes the disadvantages of the prior art.

It is an object of the present invention to provide an apparatus, and a method for an apparatus, that can act as both a pressure source and a vacuum source.

It is an object of the present invention to provide an apparatus, and a method for an apparatus, that can act as both a pressure source and a vacuum source while utilizing a minimum number of components.

It is still yet a further object of the present invention to provide any liquid or gas system/method with an apparatus, and a method for an apparatus, that can act as both a pressure source and a vacuum source.

It is yet another object of the present invention to provide fluid recovery/transfer systems that utilize a minimum number of components.

It is still yet a further object of the present invention to provide fluid recovery/transfer systems that are less prone to problems.

SUMMARY OF THE INVENTION

These and other objects of the instant invention are achieved by providing, in a system requiring both a pressure source and a vacuum source, an improvement comprising: (a) a lumen (e.g., a Venturi tube) for conveying an air stream from an upstream port of the lumen toward a downstream port of the lumen wherein the lumen includes an orifice in

the surface of the lumen located between the upstream port and the downstream port and wherein the upstream port is coupled to an air pressure source (e.g., 70–150 psi air supply); (b) a valve coupled in fluid communication with the downstream port for opening and closing off the downstream port; and (c) the orifice pulling a vacuum whenever the valve is open and the orifice generating a positive pressure whenever the valve is closed.

These and other objects of the instant invention are also achieved by providing, in a system for recovering or transferring fluid from a first location to a second location, an improvement comprising: (a) a lumen (e.g., a Venturi tube) for conveying an air stream from an upstream port of the lumen toward a downstream port of the lumen wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port and wherein the upstream port is coupled to an air pressure source (e.g., 70–150 psi air supply); (b) a valve coupled in fluid communication with the downstream port for opening and closing off the downstream port; (c) a reservoir having a first port coupled in fluid communication to the orifice; and (d) wherein the orifice pulls a vacuum in the reservoir for drawing fluid from the first location through a second reservoir port whenever the valve is open and wherein the orifice pressurizes the reservoir to evacuate the fluid therein to the second location through a third reservoir port whenever the valve is closed.

These and other objects of the instant invention are also achieved by providing an automatic fluid recovery system for recovering fluid from a main fluid system having at least one escape point (e.g., a leak point, a collection point for accumulating fluid, etc.) and returning the escaping fluid to the main system. The fluid recovery system comprises: (a) a reservoir for collecting the escaping fluid and having a plurality of ports; (b) a first valve coupled in fluid communication between a first port of the reservoir and the at least one escape point; (c) a lumen (e.g., a Venturi tube) for conveying an air stream from an upstream port of the lumen toward a downstream port of the lumen wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port and wherein the upstream port is coupled to an air pressure source (e.g., 70–150 psi air supply); (d) a second valve coupled in fluid communication to the downstream port of the lumen; (e) controller means electrically coupled to the first valve and to the second valve; (f) means responsive to the level of the fluid collected in the reservoir and electrically coupled to the controller means for providing electrical signals indicative of the level of the fluid in the reservoir to the controller means; and (g) wherein the controller means controls the activation of the first valve and the second valve, based on the electrical signals, to fill the reservoir and then to evacuate the reservoir and wherein the evacuated fluid is returned to the main fluid system via a check valve coupled in fluid communication with a third port of the reservoir. These and other objects of the instant invention are also achieved by providing a automatic fluid transfer system for transferring fluid from at least one source fluid system having a predictable (e.g., predetermined, constant, etc.) flow to a destination fluid system. The fluid transfer system comprises: (a) a reservoir for receiving fluid from the at least one source fluid system and having a plurality of ports; (b) a first valve coupled in fluid communication between a first port of the reservoir and the at least one source fluid system; (c) a lumen (e.g., a Venturi tube) for conveying an air stream from an upstream port of the lumen toward a downstream port of the lumen wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port and wherein the upstream port is coupled to an air pressure source (e.g., 70–150 psi air supply); (d) a second valve coupled in fluid communication to the downstream port of the lumen; (e) controller means electrically coupled to the first valve and to the second valve; and (f) wherein the controller means controls the activation of the first valve and second valve to collect fluid from the at least one source fluid system into the reservoir and then to evacuate the reservoir, whereby the evacuated fluid is transferred to the destination fluid system via a check valve coupled in fluid communication with a third port of the reservoir.

These and other objects of the instant invention are also achieved by providing a method for establishing a pressure source and a vacuum source. The method comprises the steps of: (a) providing an air pressure source (e.g., 70–150 psi air supply) that delivers an air stream; (b) coupling a lumen (e.g., a Venturi tube) to the air pressure source whereby the lumen conveys the air stream from an upstream port of the lumen toward a downstream port of the lumen and wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port; (c) coupling a valve in fluid communication with the downstream port for opening and closing off the downstream port; (d) opening the valve to create a vacuum source at the orifice; and (e) closing the valve to create a pressure source at the orifice.

These and other objects of the instant invention are also achieved by providing a method for recovering or transferring fluid from a first location to a second location. The method comprises the steps of: (a) providing an air pressure source (e.g., 70–150 psi air supply) that delivers an air stream; (b) coupling a lumen (e.g., a Venturi tube) to the air pressure source whereby the lumen conveys the air stream from an upstream port of the lumen toward a downstream port of the lumen and wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port; (c) coupling a valve in fluid communication with the downstream port for opening and closing off the downstream port; (d) coupling a first port of a reservoir in fluid communication with the orifice; (e) opening the valve to draw fluid from the first location into the reservoir through a second reservoir port; and (f) closing the valve to evacuate the fluid in the reservoir to the second location through a third reservoir port.

These and other objects of the present invention are also achieved by providing a method for recovering escaping fluid (e.g., leaking fluid, accumulating fluid, etc.) from at least one escape point (e.g., a leak point, a collection point where accumulating fluid gathers) in a main fluid system and returning the escaping fluid thereto. The method comprises the steps of: (a) providing an air pressure source (e.g., 70–150 psi air supply) that delivers an air stream; (b) coupling a lumen (e.g., a Venturi tube) to the air pressure source whereby the lumen conveys the air stream from an upstream port of the lumen toward a downstream port of the lumen and wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port; (c) coupling a first valve in fluid communication with the downstream port for opening and closing off the downstream port; (d) coupling a first port of a reservoir in fluid communication with the orifice; (e) coupling a second port of the reservoir in fluid communication with a second valve that is in fluid communication with the at least one escape point; and (f) controlling the operation of the first valve and the second valve to collect

escaping fluid in the reservoir through the second port and then to return the collected fluid to the main fluid system through a third reservoir port.

These and other objects of the present invention are also achieved by providing a method for transferring fluid from at least one source fluid system having a predictable flow to a destination fluid system. The method comprises the steps of: (a) providing an air pressure source (e.g., 70–150 psi air supply) that delivers an air stream; (b) coupling a lumen (e.g., a Venturi tube) to the air pressure source whereby the lumen conveys the air stream from an upstream port of the lumen toward a downstream port of the lumen and wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port; (c) coupling a first valve in fluid communication with the downstream port for opening and closing off the downstream port; (d) coupling a first port of a reservoir in fluid communication with the orifice; (e) coupling a second port of the reservoir in fluid communication with a second valve that is in fluid communication with the at least one source fluid system; and (f) controlling the operation of the first valve and the second valve to collect fluid from the at least one source fluid system into the reservoir through the second port and then to transfer the collected fluid to the destination fluid system through a third reservoir port.

DESCRIPTION OF THE DRAWINGS

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. **1** is a summary of a prior art pumping system, namely U.S. Pat. No. 2,400,651 (Marsh);

FIG. **2** is a summary of another prior art pumping system, namely U.S. Pat. No. 2,522,077 (Wahl);

FIG. **3** is a summary of another prior art pumping system, namely U.S. Pat. No. 2,664,911 (Thompson);

FIG. **4** is a summary of another prior art pumping system, namely U.S. Pat. No. 4,770,610 (Breckner);

FIG. **5** is a summary of another prior art pumping system, namely U.S. Pat. No. 4,828,461 (Laempe);

FIG. **6** is a summary of another prior art pumping system, namely U.S. Pat. No. 5,451,144 (French);

FIG. **7** is a block diagram of the present invention;

FIG. **8** is a functional diagram of the present invention with the exhaust port being in an open condition;

FIG. **9** is a functional diagram of the present invention with the exhaust port in a closed condition;

FIG. **10** is a block diagram of a first exemplary application of the present invention, known as a fluid recovery system (FRS); and

FIG. **11** is a block diagram of a second exemplary application of the present invention, known as a fluid transfer system (FTS).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in detail to the various figures of the drawing wherein like reference characters refer to like parts, there is shown at **100** in FIG. **7** a pressure/vacuum generator, which is assigned to Bijur Lubricating Corporation of Bennington, Vt.

The pressure/vacuum generator **100** comprises an air pressure source **102** (e.g., 70–150 psi air supply), a vacuum generator **104** (e.g., Bijur Part No. 27296) and a valve **106** (Bijur Part No. 27299). The air pressure source **102** is coupled to the pressure port (P) of the vacuum generator **104** and the valve **106** is coupled to the exhaust port (E) of the vacuum generator **104**. The valve **106** acts to either permit the exhaust port to be open to the atmosphere or to be closed to the atmosphere. FIGS. **8** and **9** are functional diagrams of the vacuum generator **104** with the valve **106** open (FIG. **8**) and with the valve **106** closed (FIG. **9**). As can be seen in FIGS. **8** and **9**, the vacuum generator **104** basically comprises a Venturi tube **108**; the vacuum port V comprises a small orifice **109** located just right of the center of the Venturi tube **108**. When the valve **106** is open and the air pressure source **102** is coupled to the pressure port (P) of the vacuum generator **104**, the air stream **105** creates a vacuum at the vacuum port V in accordance with the Bernoulli principle. However, when the valve **106** is closed, thereby blocking the exhaust port (E), the air stream **105** is forced through the small orifice **109**, thereby generating a positive pressure at the vacuum port V. None of the prior art teaches or suggests the control of the vacuum generator's **104** exhaust to establish both a pressure source and a vacuum source.

An exemplary application of the pressure/vacuum generator is shown in FIG. **10** which depicts a fluid recovery system (hereinafter "FRS") **200**. The FRS **200** is used as part of a main fluid system. The main fluid system (e.g., a lubrication system) comprises any number of devices that may be prone to leaks, including tubing, connectors, elbows, flanges, bearings, seals, gaskets, etc. (all of which are not shown). It is necessary to capture the leaking fluid and return it to the main fluid system.

Furthermore, in addition to restoring leaking fluid to a main fluid system, the FRS **200** also restores accumulated fluid back to the main fluid system. For example, the main fluid system in a punch press machine may intentionally overlubricate the slides/ways of the machine. As a result, an accumulation of that lubricant occurs at an accumulation point or a collection point (e.g., a collection tray). The FRS **200**, being coupled to the accumulation/collection point, also restores the accumulated fluid back to the main fluid system. Thus, it is within the broadest scope of the FRS **200** that the term "escape", "escaping", etc. as used throughout this application covers both leaking fluid (i.e., unintentional egress of fluid from the main fluid system) and accumulating fluid (i.e., intentional egress of fluid, at an accumulation point or a collection point, from the main fluid system) which cannot otherwise re-enter the main fluid system without the FRS **200**.

The escaping fluid is captured in a conduit, lumen, collection tray, etc. (indicated by reference number **208**) that is connected to, or around, these escape points (not shown). This conduit **208** is in fluid connection with the inlet to the FRS **200**. In particular, the conduit **208** is coupled to a vacuum valve **210** (e.g., Bijur Part Nos. 27300/27310). The vacuum valve **210** has an outlet coupled to a reservoir **212** (e.g., Bijur Part No. 27275). At a resevoir part **292** the reservoir **212** comprises a means **214** responsive to the level of the fluid being collected in the reservoir **212**; an example of such a means is an ultrasonic level detector (not shown), or any other type of level detection that provides a signal responsive to the level. In one embodiment, a liquid dual-level switch (e.g., Bijur Part No. 27301, 24 volts DC switch, 0.5 $amps_{max}$) is used. The liquid dual-level switch comprises an upper switch **211**, a lower switch **213** and a magnetic float **215**; when the reservoir **212** is empty, the magnetic float **215** and the lower switch **213** are electromagnetically coupled,

and the lower switch **213** outputs an "empty" signal; when the reservoir **212** is full, the magnetic float **215** and the upper switch **211** are electromagnetically coupled, and the upper switch **211** outputs a "full" signal. The reservoir **212**, at another reservoir port **291** is also in fluid communication with the vacuum port (V) of the vacuum generator **104**. The reservoir **212**, at another port **293** is also in fluid communication with an outlet check valve **216** (e.g., Bijur Part No. 27302). The outlet check valve **216** is in fluid communication with the main fluid system. A programmable logic controller (PLC) **218** (e.g., IDEC Micro-1 PLC, Type FC1A4E, Base **24** manufactured by IDEC Izumi Corp. of Japan, or any properly configured logic device, e.g., a microprocessor, a microcontroller, etc.) is electrically coupled to the solenoids of the vacuum valve **210** and the valve **106**), as well as to the means **214** responsive to the level of the fluid being collected (hereinafter the "level means **214**") in the reservoir **212**. A drain **220** is provided in the reservoir **212** for maintenance purposes.

Operation of the FRS **200** is as follows. To collect escaping fluid from the escape point(s), the PLC **218** de-energizes the valve **106** (thereby opening the valve to permit exhaust) while energizing the vacuum valve **210** (opening the valve **210**). This action causes a vacuum to be drawn in the reservoir **212**. The result is that escaping fluid from the main fluid system is drawn into the reservoir **212** through the vacuum valve **210**. As fluid is drawn in and when the fluid level causes the magnetic float **215** to be adjacent the upper switch **211**, the liquid dual-level switch outputs the "full" signal to the PLC **218**, thereby causing the PLC **218** to de-energize the vacuum valve **210** (closing the vacuum valve **210**) while energizing the valve **106**. Energizing the valve **106**, closes off the exhaust port, E, of the vacuum generator **104** which, as discussed above, converts the vacuum port, V, into a pressure port. This action pushes the collected fluid out of the reservoir **212**, through the outlet check valve **216** and back to the main fluid system **205** (or even to a liquid waste container, not shown). As the fluid leaves the reservoir **212**, the magnetic float **215** falls; when the magnetic float **215** is adjacent to the lower switch **213**, the "empty" signal is transmitted to the PLC **218** which then de-energizes the valve **106** and re-energizes the vacuum valve **210**. This cycle is then repeated.

It should be understood that a plurality of conduits, lumens, collection points, etc. (indicated by reference number **208**) from various escape points in the main fluid system, each with a respective vacuum valve **210**, can be coupled to the reservoir **212**; each vacuum valve **210** is also electrically coupled to the PLC **218**. Thus, the PLC **218** can control each vacuum valve **210** in sequence (e.g., activate one vacuum valve **210** for **10** seconds while keeping all other vacuum valves **210** closed; then shutting off that vacuum valve while opening another vacuum valve **210**, and repeating the cycle).

It should also be understood that only a single pressure/vacuum generator **100** and reservoir (e.g., reservoir **212** or **312**) are required to service a multiplicity of vacuum valves (e.g., vacuum valves **210** or **310**), as shown in FIGS. **10–11**.

It should also be understood that the level means **214** in the FRS **200** covers all types of mechanisms that couple the level of the fluid collected in the reservoir **212** to the valve **106** and the vacuum valve **210**. In other words, as shown, the level means **214** provides an electrical signal to the PLC **218** which, in turn, controls the respective solenoids of the valve **106** and the vacuum valve **210** at the appropriate times. However, it is within the broadest scope of the FRS **200** that the level means **214** includes a direct interface with the valve **106** and the vacuum valve **210** so that movement of the level means **214** closes/opens the valve **106** while closing/opening the vacuum valve **210**.

Another exemplary application of the pressure/vacuum generator is shown in FIG. **11** which depicts an automatic fluid transfer system (hereinafter "FTS" **300**). The FTS **300** is similar to the FRS **200**, except that the FTS **300** involves transferring a source fluid from a source fluid system **303**, having a predictable (e.g., predetermined, constant, etc.) flow, to a destination fluid system **305**. Since the flow of the source fluid system **303** is predictable, there is no need to monitor the level of the fluid collecting in the reservoir **312**. As a result, the PLC **318** (or sequential timer, or other timing devices) can operate on a timing basis rather than having to sense the reservoir **312** fluid level. Other than that, the components of the FTS **300** correspond to the components of the FRS **200**, whereby the reference numbers beginning with "3—" are the same for those reference numbers beginning with "2—". Furthermore, as shown in FIG. **11**, the FTS **300** can operate using a plurality of source fluid systems **303** (each having a predictable, e.g., predetermined, constant, etc., flow) for transferring source fluids from each of their respective source fluid systems to the destination fluid system **305**.

The important aspect of the pressure/vacuum generator **100** is the automatic valving of the exhaust port, E, of the vacuum generator **104**. Valving the exhaust port permits the use of a single source to act as both the "puller" and "pusher" of a fluid while using only a single valve (**106**). This increases the reliability of any system (e.g., the FRS **200**/FTS **300**) which uses the pressure/vacuum generator **100** by decreasing the number of components that can fail while reducing the cost of the fluid systems' operation. Thus, it should be understood that the present invention **100** has an unlimited number of applications and that the FRS **200** and the FTS **300** discussed above are only by way of example.

It should be understood that the term "fluid" used throughout the present application includes both liquids and gases and therefore the pressure/vacuum generator **100**, as well as the FRS **200** and FTS **300**, discussed above, can all be implemented for gas systems also. In addition, the term "automatic" used throughout the present application identifies that there is no manual operation involved in order for the FRS **200** or the FTS **300** to operate.

It should also be understood that where the valves depicted in the present application use electric solenoid control, other types of control (e.g., pneumatically-controlled valves) are also covered by the broadest scope of this invention.

Without further elaboration, the foregoing will so fully illustrate my invention that others may, by applying current or future knowledge, readily adopt the same for use under various conditions of service.

I claim:

1. In a system for recovering or transferring fluid from a first location to a second location, the improvement comprising:

(a) a lumen for conveying an air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port, said upstream port being coupled to an air pressure source;

(b) a valve coupled in fluid communication with said downstream port for opening and closing off said downstream port;

(c) a reservoir having a first port coupled to said orifice; and

(d) said orifice pulling a vacuum in said reservoir for drawing fluid from the first location through a second reservoir port whenever said valve is open and said orifice pressurizing said reservoir to evacuate the fluid therein to the second location through a third reservoir port whenever said valve is closed, said lumen not being exposed to the fluid.

2. The improvement of claim 1 wherein said lumen comprises a Venturi tube.

3. An automatic fluid recovery system for recovering fluid from a main fluid system having at least one escape point and returning the escaping fluid to the main system, said fluid recovery system comprising:

(a) a reservoir for collecting the escaping fluid and having a first port, a second port and a third port;

(b) a first valve coupled in fluid communication between said first port of said reservoir and the at least one escape point;

(c) a lumen for conveying an air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port, said upstream port being coupled to an air pressure source, and said orifice being coupled to said second reservoir port, said lumen not being exposed to the fluid;

(d) a second valve coupled in fluid communication to said downstream port of said lumen;

(e) controller means electrically coupled to said first valve and to said second valve;

(f) means responsive to the level of the fluid collected in said reservoir electrically coupled to said controller means for providing electrical signals indicative of the level of the fluid in said reservoir to said controller means; and

(g) wherein said controller means controls the activation of said first valve and said second valve, based on said electrical signals, to fill said reservoir and then to evacuate said reservoir, said evacuated fluid being returned to said main fluid system via a check valve coupled in fluid communication with said third port of said reservoir.

4. The fluid recovery system of claim 3 wherein said first valve is normally closed and is opened when activated by said controller means.

5. The fluid recovery system of claim 3 wherein said second valve is normally open and is closed when activated by said controller means.

6. The fluid recovery system of claim 3 wherein said lumen comprises a Venturi tube.

7. The fluid recovery system of claim 3 wherein said level detecting means responsive to said level of the fluid collected in said reservoir is a fluid dual-level switch that comprises:

(a) float portion that floats on the fluid collected in said reservoir;

(b) an upper switch portion which, when electromagnetically coupled to said float portion, generates a first electrical signal to said controller means indicative of a full reservoir; and

(c) a lower switch portion which, when electromagnetically coupled to said float portion, generates a second electrical signal to said controller means indicative of an empty reservoir.

8. An automatic fluid transfer system for transferring fluid from at least one source fluid system having a predictable flow to a destination fluid system, said fluid transfer system comprising:

(a) a reservoir for receiving fluid from the at least one source fluid system and having a first port, a second port and a third port;

(b) a first valve coupled in fluid communication between said first port of said reservoir and the at least one source fluid system;

(c) a lumen for conveying an air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port, said upstream port being coupled to an air pressure source, and said orifice being coupled to said second reservoir port;

(d) a second valve coupled in fluid communication to said downstream port of said lumen;

(e) controller means electrically coupled to said first valve and to said second valve; and

(f) wherein said controller means controls the activation of said first valve and said second valve to collect fluid from the at least one source fluid system into said reservoir and then to evacuate said reservoir, said evacuated fluid being transferred to the destination fluid system via a check valve coupled in fluid communication with said third port of said reservoir, said lumen not being exposed to the fluid.

9. The fluid recovery system of claim 8 wherein said first valve is normally closed and is opened when activated by said controller means.

10. The fluid recovery system of claim 8 wherein said second valve is normally open and is closed when activated by said controller means.

11. The fluid recovery system of claim 8 wherein said lumen comprises a Venturi tube.

12. A method for recovering or transferring fluid from a first location to a second location, said method comprising the steps of:

(a) providing an air pressure source that delivers an air stream;

(b) coupling a lumen to said air pressure source, said lumen conveying said air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port;

(c) coupling a valve in fluid communication with said downstream port for opening and closing off said downstream port;

(d) coupling a first port of a reservoir to said orifice without exposing said lumen to the fluid;

(e) opening said valve to draw fluid from the first location into said reservoir through a second reservoir port; and

(f) closing said valve to evacuate the fluid in said reservoir to the second location through a third reservoir port.

13. The method of claim 12 wherein said lumen comprises a Venturi tube.

14. A method for recovering escaping fluid from at least one escape point in a main fluid system and returning the escaping fluid thereto, said method comprising the steps of:

(a) providing an air pressure source that delivers an air stream;

(b) coupling a lumen to said air pressure source, said lumen conveying said air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port;

(c) coupling a first valve in fluid communication with said downstream port for opening and closing off said downstream port;

(d) coupling a first port of a reservoir to said orifice without exposing said lumen to the fluid;

(e) coupling a second port of said reservoir in fluid communication with a second valve that is in fluid communication with the at least one escape point; and

(f) controlling the operation of said first valve and said second valve to collect escaping fluid in said reservoir through said second port and then to return the collected fluid to the main fluid system through a third reservoir port.

15. The method of claim **14** wherein said step of controlling the operation of said first valve and said second valve comprises:

(a) opening said first and second valves to draw fluid from the at least one escape point into said reservoir through said second reservoir port;

(b) detecting the level of fluid collecting in said reservoir;

(c) closing said first and second valves, whenever the detected level is full in said reservoir, to evacuate the fluid in said reservoir through said third reservoir port to return the escaping fluid the main fluid system;

(d) opening said first and second valves whenever the detected level is empty in said reservoir; and

(e) repeating steps (a)–(d).

16. The method of claim **15** wherein said step of detecting the level of fluid collecting in said reservoir comprises:

(a) providing a valve controller for controlling said first and second valves;

(b) providing a first electrical switch adjacent the bottom of said reservoir;

(c) providing a second electrical switch adjacent the top of said reservoir;

(d) providing a magnetic float that is moved by the fluid collecting in said reservoir wherein said magnetic float electromagnetically couples to said first electrical switch when said reservoir is empty and wherein said magnetic float electromagnetically couples to said second electrical switch whenever said reservoir is full;

(e) transmitting a first electrical signal to said valve controller whenever said first electrical switch is electromagnetically coupled to said magnetic float and transmitting a second electrical signal to said valve controller whenever said second electrical switch is electromagnetically coupled to said magnetic float.

17. The method of claim **14** wherein said lumen comprises a Venturi tube.

18. A method for transferring fluid from at least one source fluid system having a predictable flow to a destination fluid system, said method comprising the steps of:

(a) providing an air pressure source that delivers an air stream;

(b) coupling a lumen to said air pressure source, said lumen conveying said air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port;

(c) coupling a first valve in fluid communication with said downstream port for opening and closing off said downstream port;

(d) coupling a first port of a reservoir to said orifice without exposing said lumen to the fluid;

(e) coupling a second port of said reservoir in fluid communication with a second valve that is in fluid communication with the at least one source fluid system; and

(f) controlling the operation of said first valve and said second valve to collect fluid from the at least one source fluid system into said reservoir through said second port and then to transfer the collected fluid to the destination fluid system through a third reservoir port.

19. The method of claim **18** wherein said step of controlling the operation of said first valve and said second valve comprises:

(a) opening said first and second valves to draw fluid from the at least one source fluid system into said reservoir through said second reservoir port;

(b) closing said first and second valves to evacuate the fluid in said reservoir through said third reservoir port to transfer the fluid to the destination fluid system;

(c) opening said first and second valves; and

(d) repeating steps (a)–(c).

20. The method of claim **18** wherein said lumen comprises a Venturi tube.

* * * * *

(B) Evidence for Claims 1-24 – Entered

The following items (1) – (35) listed below are hereby entered as evidence entered by the Examiner. Also listed for each item is where said evidence was entered into the record by the Examiner.

(1) Copy of US Patent Number 5988221 ("Walker, Dewey W."). This evidence was entered into the record by the Examiner on Notice of Reference Cited line A of the Office Action mailed 01/21/2005.

(2) Reference US Patent Number 2346728 ("Carlson"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(3) Reference US Patent Number 2514059 ("Hicks et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(4) Reference US Patent Number 3467301 ("Doyle et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(5) Reference US Patent Number 3623500 ("Hoy"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(6) Reference US Patent Number 3712331 ("Otto"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(7) Reference US Patent Number 3730228 ("Gibbs, Sr."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(8) Reference US Patent Number 3811462 ("Feliz"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(9) Reference US Patent Number 3882565 ("Irwin et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(10) Reference US Patent Number 3958297 ("Hukuba et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(11) Reference US Patent Number 4133347 ("Mercer"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(12) Reference US Patent Number 4180102 ("Larkin"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(13) Reference US Patent Number 4223702 ("Cook"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(14) Reference US Patent Number 4231595 ("Knutsen"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(15) Reference US Patent Number 4650224 ("Smith"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(16) Reference US Patent Number 4779650 ("Sargent et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(17) Reference US Patent Number 4796926 ("Rapsilver"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(18) Reference US Patent Number 4854349 ("Foreman"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(19) Reference US Patent Number 5023959 ("Mercer"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(20) Reference US Patent Number 5078180 ("Collins"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(21) Reference US Patent Number 5244003 ("Boomgaarden"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(22) Reference US Patent Number 5247974 ("Sargent et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(23) Reference US Patent Number 5636648 ("O'Brien et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(24) Reference US Patent Number 5653262 ("Hanemaayer"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(25) Reference US Patent Number 5697285 ("Nappi et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(26) Reference US Patent Number 5816639 ("DiBiagio et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(27) Reference US Patent Number 5823869 ("Paturzo"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(28) Reference US Patent Number 5904183 ("Leech"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(29) Reference US Patent Number 5951082 ("DiBiagio et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(30) Reference US Patent Number 5988221 ("Walker"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(31) Reference US Patent Number 6024134 ("Akedo et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(32) Reference US Patent Number 6607009 B2 ("Schoellhorn et al."). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

(33) Reference US Patent Application 2002/079017 A1 ("Fields"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/11/2008.

(34) Reference US Patent Number 2852216 ("Peters"). This evidence was entered into the record by the Examiner on 01/2005 as noted on the IDS previously submitted by Applicant and now part of the Office Action mailed 01/21/2005.

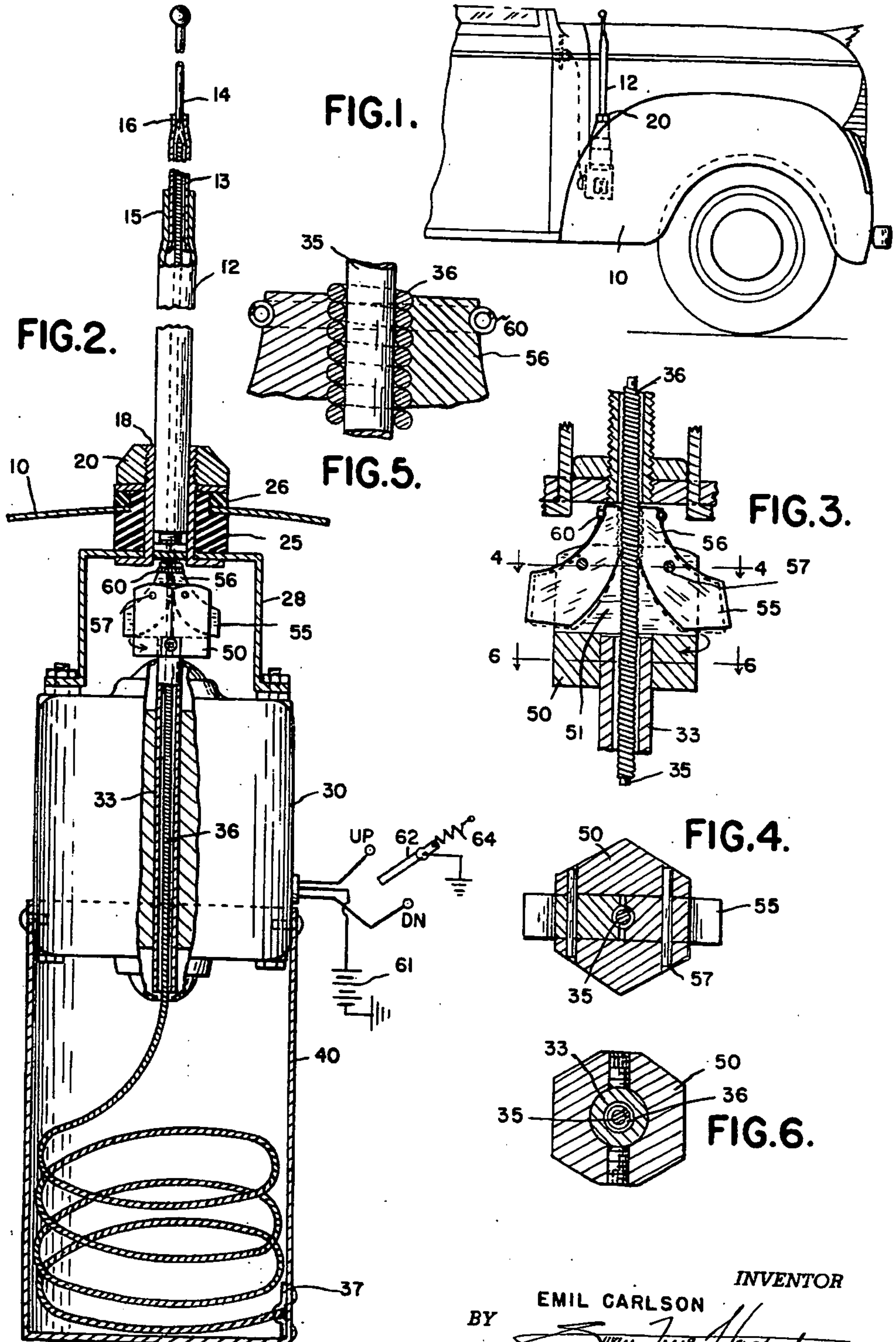
(35) Reference US Patent Number 6224345 ("Dussault"). This evidence was entered into the record by the Examiner on page 4 paragraph 4. of the Office Action mailed on 01/11/2008.

Copies of all References follows.

April 18, 1944. E. CARLSON 2,346,728

POWER DRIVEN OPERATING MEANS FOR EXTENSIBLE AND RETRACTABLE AERIALS

Filed Oct. 20, 1941



INVENTOR
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BY
ATTORNEYS

UNITED STATES PATENT OFFICE

2,346,728

POWER DRIVEN OPERATING MEANS FOR EXTENSIBLE AND RETRACTABLE AERIALS

Emil Carlson, Detroit, Mich.

Application October 20, 1941, Serial No. 415,674

2 Claims. (Cl. 254—135)

This invention relates to telescoping radio antennae, and operating means therefor, and is particularly concerned with the provision of improved means, of simple, compact, rugged and foolproof character, whereby telescoping antenna sections and the like may be operated, to extend and retract the same, the operation being controllable from a remote point if desired, and the arrangement being such as to provide quick operation of the parts.

Another object is to provide such a power-operating mechanism which is so arranged that no damage can be done to the operating parts if the antenna is retracted or extended by hand, or in event of an attempt to drive it beyond the fully extended or retracted portion by means of the power actuating mechanism.

Other objects and advantages will be apparent from the following description, wherein reference is made to the accompanying drawing illustrating preferred embodiment of the invention and wherein similar reference numerals designate similar parts throughout the the several views.

In the drawing:

Fig. 1 is a fragmentary side elevational view of the front portion of a motor car, showing the same provided with an aerial constructed in accordance with the present invention.

Fig. 2 is a view partly in substantially central longitudinal section and partly in side elevation, showing the aerial on a larger scale and indicating the manner of installation thereof.

Fig. 3 is an enlarged substantially diametric section of the driving mechanism and adjacent parts.

Fig. 4 is a cross section taken substantially on the line 4—4 of Fig. 3, and looking in the direction of the arrows.

Fig. 5 is a fragmentary sectional detail of the gripping portions of the driving jaw members, showing the manner in which they engage the actuating cable; and

Fig. 6 is a horizontal section taken substantially on the line 6—6 of Fig. 3, and looking in the direction of the arrows.

Referring now to the drawing, reference character 10 designates the fender of a motorcar, which is illustrated as supporting the entire antenna and its driving mechanism, although it will readily be appreciated that the antenna itself might be located or supported in any other desired position or manner, and that the extensible and retractable sections might in fact be intended to serve as a mast or support or the like rather than as an antenna.

The illustrated antenna is formed in three sections, the lowermost of which, designated 12, is fixed, while the two telescoping sections 13—14 are slidable therein, and retained against unwanted separation by reduced neck portions as 15—16 and cooperating enlarged ends (undesignated) in the usual manner.

The section 12, constituting a basic support section, is fast at its lower end in a short sleeve 18, which is threaded at its top to receive the clamping nut 20. A shouldered bushing 25, formed of insulating material, and a coacting insulating washer 26, are fitted over the sleeve 18 and adapted to be clamped, when the nut 20 is tightened, to retain the assembly in position upon the fender 10 in the manner clearly shown in Fig. 2.

Secured to the lower end of the sleeve 18 is a supporting bracket 28 of inverted U-form, the depending legs of which carry the electric motor 30. The motor shaft 33 is axially aligned with the telescoping antenna sections, and is hollow. The motor is of the reversible type.

A flexible cable 35, of the variety having a helically coiled external wrapping, 36, of wire or the like, is attached to the topmost antenna section 14, and extends downwardly through the other sections, and through the hollow motor shaft, into a cylindrical casing 40 secured to and depending from the motor. Enough of the flexible cable is provided to enable extension of the antenna, and the lower end of the cable is made fast to the inner periphery of the can 40, as by means of the clamp 37. The clamp 37 holds the wire or cable 35 tightly, to prevent it from twisting about its own axis, and the wire projects in such direction that it tends to coil itself within the can, as shown in Fig. 2.

Fixed upon the motor shaft in the space between the motor and the bottom of the antenna assembly is a driving mechanism, best shown in Fig. 3, consisting of a hollow body portion 50, the upper portion of which is slotted, as at 51, to permit the cable 35 to pass freely therethrough and to receive a pair of pivoted drivers, each of which consists of an integral flyweight section 55 and a nose portion 56 having a partly cylindrical and threaded inner surface adapted to engage the surface of the cable. The supporting pivot pin 57 of each driver is arranged transversely between the nose and flyweight sections, in such manner that the nose portion, which is provided with threads corresponding to and adapted to interfit

with the helical configuration of the exterior of the cable formed by the wrapping, may move to and from engagement with such surface. The flyweight sections are heavier than the nose sections, and farther from the center of rotation, so that rotation of the motor shaft tends to throw the flyweight sections outwardly, forcing the threaded nose sections 56 inwardly and against the wire wrapping, pressure being maintained in this fashion to raise or lower the antenna, as the case may be. Centrifugal pressure may be augmented, if desired, by an endless spring 60 wrapped around and tending to contract the nose portions.

In event the antenna sticks, or is held, or is manipulated by hand, or if an attempt is made to drive the antenna beyond the end of its movement, the toothed nose portions simply ratchet over the helical cable winding, the drivers rocking on their pins 57.

A source of current 61 and operating switch 62 are diagrammatically illustrated in Fig. 2. A spring 64 tends to center the switch, which is movable to one contact marked "Up" to raise the antenna, and to another contact marked "Dn" to turn the motor in the reverse direction, to lower the antenna. The direction of rotation of the motor in lowering the antenna is such as to tend to coil the cable in the can, and vice-versa. I have found that the cable will in this manner coil itself in and uncoil from the container without tangling or catching.

It is to be noted that although the lower end of the cable is held against twisting, the upper end is free to turn. This turning or twisting of the upper end of the cable may take place either with or independently of the section 14, and occurs to the extent which is necessary to enable coiling and uncoiling of the portion in the container 40. In the shown construction the cable is fast in the section 14, and the latter is rotatable in the section 15, although this is a matter of choice.

I am aware that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present embodiment to be considered in all respects as illustrative and not restrictive; reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

I claim:

1. Means for actuating a desired element longitudinally, comprising in combination with a flexible cable secured at its end to said element and having a helical surface configuration, a container into which said cable may be coiled, means for securing the other end of the cable in the container and against unwanted twisting about its longitudinal axis, a power source, driving nut means comprising oppositely arranged pivoted arms each carrying threads on its inner face at one end and weighted at its other end whereby centrifugal action may move the threaded faces toward the cable and engage the helical surface thereof, said driving nut means being rotatable by the power means but held against longitudinal movement with the cable, whereby upon rotation of said nut means the cable and the actuated element attached thereto may be moved longitudinally, the cable being concomitantly moved into or out of the container, depending upon the direction of rotation of the nut means, that portion of the cable engaged by said nut means being rotatable about its own axis sufficiently to permit coiling and uncoiling of the cable within the container, and the nut means being arranged to turn in a direction tending to coil the cable when moving the cable into the container, and in a direction tending to uncoil the cable when moving the cable out of the container.

2. Means for actuating a cable having a helical surface configuration longitudinally into and out of a coiled condition without rotating the coil bodily, comprising a fixed container in which the cable is adapted to lie in substantially circular coils, means for securing one end of the cable in the container and against unwanted turning about its own axis, a driving nut comprising threaded members centrifugal movable into engagement with the helical surface configuration of the cable and rotatable thereabout, means for holding the nut against longitudinal movement, whereby rotation of the nut drives the cable longitudinally into and out of the container, while twisting the cable sufficiently to coil and/or uncoil the same, the axis of rotation of the nut being substantially parallel to the axis of the coil-receiving portion of the container and of the coil of cable when the cable is coiled in the container.

EMIL CARLSON.

July 4, 1950 J. R. HICKS ET AL 2,514,059

COUPLING DEVICE

Filed May 18, 1944

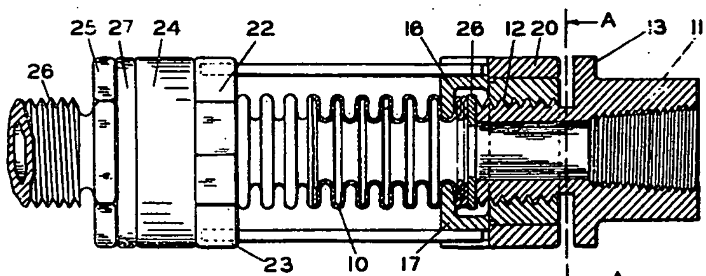

FIG. 1

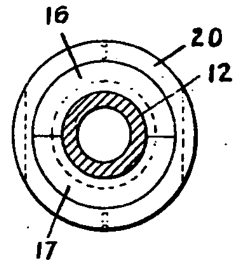

FIG. 2

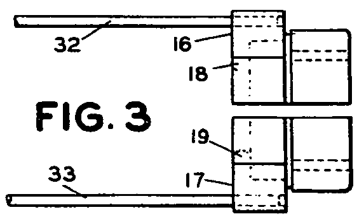

FIG. 3

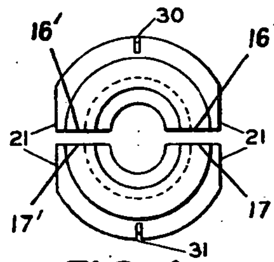

FIG. 4

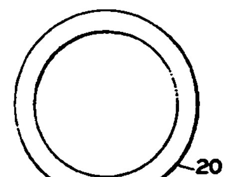

FIG. 5

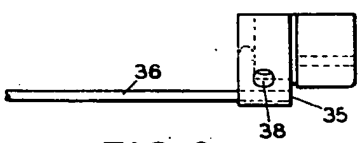

FIG. 6

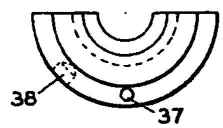

FIG. 7

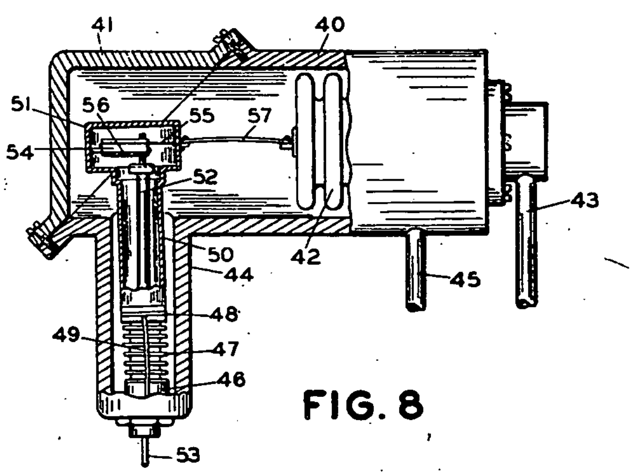

FIG. 8

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Patented July 4, 1950

2,514,059

UNITED STATES PATENT OFFICE

2,514,059

COUPLING DEVICE

James R. Hicks, Waterbury, and Raymond S. Ellis, Watertown, Conn., assignors to The Bristol Company, Waterbury, Conn., a corporation of Connecticut

Application May 18, 1944, Serial No. 536,072

4 Claims. (Cl. 285—90)

1

The invention relates to coupling devices for flexible metallic hose, and more especially to a coupling which may be applied to a section of such hose by purely mechanical means, and without the necessity of soldering, brazing, welding or other applications of high temperature.

In the interconnection of sections of flexible metallic hose of the bellows type, or in the provision of solid couplings, whereby such hose may be connected to a rigid piping system or to a pressure vessel, there arises the problem of providing ready means for establishing such connection without the need of highly specialized tools or of treatment involving the subjection of portions of the flexible hose to high temperatures.

It is an object of the present invention to provide a coupling, whereby a section of flexible metallic hose may be quickly and positively connected to a rigid structure by purely mechanical means.

It is a further object to provide a coupling of the above class, which may be repeatedly disassembled and re-assembled.

It is a further object to provide a coupling of the above nature adapted to installation within a restricted space.

It is a further object to provide a coupling of the above nature adapted to installation with a minimum sacrifice of desired flexibility in the portions of metallic hose to which it is applied.

It is a further object to provide a coupling of the above nature which may be adapted to constraint of flexibility of the connected portion to a single plane of motion.

It is a further object to provide a coupling of the above nature which is free from the tendency to change its longitudinal dimensions under the influence of tension or compression.

It is a further object to provide a coupling which, while flexible, shall have a minimum tendency to develop kinks and sharp bends.

In carrying out the purposes of the invention, it is proposed to provide a clamping fitting adapted to coaction with a section of flexible metallic hose of the so-called "annular convolution" type (as contrasted to that type in which the convolution forms a continuous helix) and to engage one or more convolutions at the extremity of said section, and longitudinally to compress and maintain the same in fluid-tight engagement with a solid fitting to which said hose is to be connected. In view of the circumferential nature of the grooves characterizing this class of metallic hose, the portions of the coacting fitting are divided upon a plane substantially within which lies the axis of the hose. By this expedient said fittings may be laterally applied, and afterwards retained in place by suitable constraining means. For the purpose of restricting flexure to a single plane, provision is made for connecting the clamping fittings at opposite extremities of the section of flexible hose by means of diametrically opposed resilient rods, strips, or wire of spring material, which also serve to prevent longitudinal changes in the dimensions of the coupling, and also to reduce the tendency toward the development of kinks or sharp bends.

2

In the drawings, Fig. 1 is a side elevation, partly in section, of a flexible coupling embodying the principles of the invention.

Fig. 2 is an end elevation, partly in section, taken on the line A—A in Fig. 1.

Figs. 3 and 4 are side and end elevations, respectively, of certain elements of the device shown in Fig. 1.

Fig. 5 is an end elevation of an element adapted to coact with the elements shown in Figs. 3 and 4 in effecting the purpose of the invention.

Figs. 6 and 7 are side and end elevations, respectively, of a type of element which may be substituted for the elements shown in Figs. 3 and 4.

Fig. 8 is a side elevation partly in section, and to a reduced scale, of a differential manometer incorporating in its structure a coupling involving the invention.

Referring now to the drawings: In Figs. 1 and 2 is shown a flexible coupling embodying the principles of the invention. The numeral 10 designates a portion of flexible metallic hose of the bellows type, having annular convolutions, to which it is required to fit solid portions, whereby there may be constituted a flexible tubular coupling between said portions. A terminal fitting 11 is provided with a threaded annular portion 12, having a flattened end adapted to be juxtaposed to a severed and trimmed end of the metallic hose 10. The portion of the fitting 11 remote from the threaded part 12 may be provided with a conventional pipe thread as shown, or may be otherwise adapted to rigid connection to a tubular or hollow structure to which it is required that external connection be made. It is desirable that the fitting 11 be provided with an enlarged portion 13 of hexagonal section, or the equivalent, for engagement by a suitable wrench or spanner to facilitate assembly of the coupling.

Two identical elements 16 and 17, each of sub-

stantially semicircular conformation, have, formed upon the interior surfaces, complementary portions of an internal thread, adapted, when said elements are juxtaposed with their flat faces 16', 17' together, to provide a split nut adapted for engagement with the threaded portion 12 of the fitting 11. Also formed upon the interior curved faces of the elements 16 and 17 are portions 18 and 19 respectively of an internally directed flange having rounded edges and adapted to enter the space between two convolutions of the flexible hose portion 10, after the same have been separated by a suitable spreading tool. The portions of the elements 16 and 17 exterior to the threaded parts are formed to a smooth surface of cylindrical curvature such that when said elements are placed in engagement to form a nut, said surfaces will have a truly circular conformation. A solid ring 20, bored on the interior to have a curvature corresponding to the exterior surface of the elements 16 and 17, is adapted to be forced over said surface when said elements are in engagement, whereby to coordinate them into an integral element having a continuous thread adapted to engagement with the threaded portion of the fitting 11. The elements 16 and 17 may have formed upon their exterior surfaces flattened portions 21, adaptable to engagement by a wrench, whereby when said elements are coordinated into an integral nut the same may be effectively tightened upon the threaded portion 12 of the fitting 11.

Where it is required only to provide a coupling between a rigid structure, such as a standard piping system, and a section of flexible hose of indeterminate length, the combination as thus far described constitutes the only necessary apparatus; and a fluid-tight joint may be made according to the method presently to be described. Where it is desired that there be provided between two rigid bodies a coupling of limited invariable length, flexible for deflection through a small angle in one plane, and substantially inflexible in all other directions, there is selected a portion 10 of flexible metallic hose suited to the dimensions of the fitting 11 and associated parts as hereinabove described, and of a length suited to the distance to be maintained between said bodies. One end of said hose portion being adapted to connection to the cooperating elements described, the remote end is provided with an assembly similar in all respects to that set forth, whereby to form a further rigid connection. This comprises semicircular portions 22 and 23 identical in all respects with the portions 16 and 17, together with a solid ring 24 identical with the ring 20 and adapted for maintaining the portions 22 and 23 in definite engagement to form a split nut. A solid fitting 25 similar to the fitting 11 is provided with an internally projecting threaded portion, not shown in the drawings, but identical to the portion 12 of the fitting 11, adapted to engage the internal thread formed by the coacting elements 22 and 23. The fitting 25 may be provided with any convenient means for external connection; and, while this may be an internal thread similar to that in the fitting 11, it is here shown as an external threaded portion 25 adapted for engagement by a suitable nut.

The elements 16 and 17 are provided with diametrically opposed slots 30 and 31 formed, as by milling, at points 90 degrees removed from the plane surfaces 16', 17' of said elements; and similar slots are formed in the corresponding parts of the elements 22 and 23. Placed in said slots, and secured therein, as by soldering or brazing, are resilient metallic strips 32 and 33 of spring steel or the like, adapted for bending through a limited angle in a sense parallel to the planes of said surfaces, and at the same time to inhibit substantial bending in planes transverse to the planes of said surfaces, as well as to maintain a fixed degree of longitudinal separation between the elements to which they are respectively attached, thus constituting a pair of clamping members adapted to cooperate with a suitable length of metallic hose in carrying out the purposes of the invention.

The selected portion of hose, being suitably trimmed at its extremities, and at a distance apart determined by the spacing of the internal flange members on the spaced-apart semicircular half-nuts, the interstices between adjacent convolutions are opened by means of a suitable spreading tool, and the flanges placed in said interstices, the flat surfaces 16', 17' of elements being brought into engagement, providing complete encirclement of the ends of the flexible metallic hose portion, and the internally threaded portions of said elements combining to form a thread for engagement by the threaded portions of the fittings 11 and 25. The rings 20 and 24 are forced over the cylindrical surfaces of the corresponding nut-elements, incorporating each into a complete unit, after which the fittings are screwed into place, engaging the convolutions of the flexible hose portion which lie between the ends of the fittings and the corresponding internal flanges, and compressing said convolutions between said flattened faces and said flanges. If desired, there may be placed between the end of each fitting and the compressed convolutions of the flexible metallic hose a washer or gasket, as shown at 26 in Fig. 1, whereby in some instances to improve the joint so formed. There may also if desired be provided a resilient washer as shown at 27 in Fig. 1, interposed between the retaining ring and the enlarged portion of the solid fitting, whereby to exert an axial constraint between said fitting and ring, effectively preventing any tendency of the latter to shift out of complete retaining engagement with the semicircular elements.

In Figs. 6 and 7 is shown a form of clamping member which may be used alternatively with those shown in Figs. 3 and 4 for the purpose of providing a flexible connection of fixed length between two solid fittings in the same manner as said last-named members are used. A semicircular element 35 is formed similar in all respects to either of the elements 16—17, with the exception that instead of a flat strap of resilient material secured in a slot for the purpose of establishing connection to the similar element at the remote end of the coupling, there is provided a wire 36 of spring steel, or equivalent material having circular cross section, said wire being secured in a hole 37 drilled in the material of the fitting 35. A further feature wherein the member shown in Figs. 6 and 7 differs from those shown in Figs. 3 and 4 is found in the omission of the flattened surfaces 21 shown in Fig. 4, and the provision of a radial opening 38 formed in the outer periphery of the fitting and adapted to engagement by a suitable spanner for the purpose of rotating the element, when combined with similar part to form a complete nut for coacting with the externally threaded portion of the solid fitting. It is understood that the replacement of the flat sur-

faces 21 by the opening 38 is not necessarily restricted to that form of element which is provided with the wire 36 instead of a flat strip of spring material, but is adapted to any form of interconnection within the spirit of the invention, and that said elements may be provided with any superficial conformation adapted to engagement by a suitable wrench or spanner.

There has thus been provided for flexible metallic hose of the "annular convolution" type a coupling whereby to produce a fluid tight seal between said hose and a rigid structure, with a minimum number of component parts, and one which, by virtue of the incorporation of the functions of an internally directed flange and a split nut in a common element, effects the desired result by means of an assembly having a minimum diameter in excess of that of the hose material, and is hence adapted to use in restricted spaces. As an example of the special adaptability of a coupling of the type incorporating the principles of the invention to use in a restricted space, there is shown in Fig. 8 a view, partly in section, of a differential fluid-pressure meter utilizing such a coupling member as a flexible seal between internal and atmospheric pressure. This type of instrument is fully disclosed and claimed in copending application Serial No. 483,824, filed April 20, 1943, by James R. Hicks, one of the present applicants, now Patent No. 2,441,882.

Referring to Fig. 8, the numeral 40 designates an extended shell, housing or meter body adapted to contain elements of a measuring instrumentality presently to be described, and having a removable cover-plate 41, whereby access may be had to said elements. Internally attached to one end of said housing is a closed expansible bellows member 42 having its interior in communication with a conduit 43, and adapted to vary its linear dimensions in correspondence with the difference in magnitude between a fluid pressure interiorly applied through said conduit and pressure applied to the outside surface of said bellows. Laterally extending from the housing 40 near its extremity remote from the attachment of the bellows member 42 is a tubular projection 44, having a flattened outer end with an aperture therein adapted for mounting of certain elements of the mechanism. A conduit member 45 communicating with the interior of the shell or housing 40 provides for the external application of fluid pressure to the bellows member 42, so that the magnitude of the difference between pressures in the conduits 43 and 45 will be expressed by a linear deformation of said member within the housing 40. Secured to the inner face of the projecting portion 44 is the solid end fitting 46 of a flexible coupling member similar to that shown in Fig. 1, and including a section of metallic hose 47, and a further solid fitting 48, said fitting and hose being coordinated into a flexible tubular structure according to the manner hereinbefore set forth. Diametrically opposed strips or wires 49 of spring material (only one of which appears in the drawing) serve to maintain the solid fittings 46 and 47 at a fixed distance apart, and to limit the flexure of the coupling element to a direction substantially parallel to the line of deflection of the bellows member 42 with changes in differential pressure to which said member is subjected. In other words, the longitudinal axis of said coupling element can flex only in a plane substantially perpendicular to the plane passing

through said strips or wires 49, said perpendicular plane either passing through or extending substantially parallel to the longitudinal axis of the bellows 42.

Secured to the fitting 48 is a tubular structure 50, extending into the main body of the housing 40, and terminating in an enlarged head portion 51, said structure and head portion, together with the flexible coupling, forming an inner shell or housing, movable through a limited angle as permitted by the flexible hose portion 47 and constrained by the strips 49. The interior of said inner shell or housing is in free communication with the atmosphere through the aperture in the end of the projection 44, and is completely sealed from the interior of the housing 40. Rigidly mounted on the end of the projection 44 and extending within the inner shell or housing as above constituted is a support 52 having journalled therein a shaft member 53 for free rotation, and extending through the mounting in the aperture at the end of the projection 44, and externally of the meter body adapted for attachment of an index, pointer, or other instrumentality, not shown in the drawing, whereby to measure or otherwise utilize the angular deflection of said shaft member. Carried by the inner end of the shaft member 53, within the enlarged portion 51 of the inner movable housing, is a drum or sector member 54, said sector member being operatively connected to the interior walls of the enlarged portion 51 by link members 55 whereby motion of the inner housing in its plane of freedom will impart angular motion to said sector member and thereby to the shaft member 53. A flexible link 57 provides operative connection between the inner extremity of the bellows member 42 and the outer surface of the head portion 51, to cause said head portion to partake of deflections of said bellows member with variations in differential pressure to which the same is subjected. Thus, the deflected position of the inner housing in the plane of motion permitted by the flexible coupling will be representative of the magnitude of the differential pressure between the conduits 43 and 45, and this, being communicated through the links 55 and 56 to the sector member 54 and thereby to the shaft 53, will impart to the latter a proportional angular deflection, which will be a measure of the differential pressure.

While no invention is herein claimed for the differential pressure gauge, all of which is covered in the hereinbefore mentioned Hicks application, Serial No. 483,824, it will be apparent that the form of flexible member covered by the present invention is especially applicable to that form of apparatus. The outstanding advantages accruing to said member in its designated use both in accordance with the principles of the invention, and as fully demonstrated by experiment, may be summarized as follows: (1) The coupling may be assembled, and disassembled without the use of brazing, soldering, or welding processes. (2) The small over-all diameter of the unit, as compared with other mechanical types not having integral parts each of which combines the nut and flange functions, lends itself to use in the relatively restricted space provided within the meter body or housing. (3) Constraint of flexure to a single plane improves accuracy of measurement, and also inhibits undesirable vibration in other planes. (4) The definite length established by the resilient reinforcing strips or wire effectually prevents longi-

tudinal deformation with variation of static pressure within the meter body and thus prevents such misalignment of the interior mechanism as might take place under extreme pressures in forms of flow meter not so equipped.

The terms and expressions which we have employed are used as terms of description and not of limitation, and we have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

We claim:

1. A flexible tubular structure comprising a section of corrugated metallic tubing provided at each of its extremities with fittings comprising split nuts, the separating surfaces of said respective nuts lying substantially in a common plane, and resilient extended members of fixed length, each integrally connecting corresponding parts of said fittings at opposite extremities of said tubing and extending between points on the same side of said plane, whereby to inhibit deformation of said tubing section under longitudinal stress while enabling flexure of said section in a given plane.

2. A flexible tubular structure comprising a section of corrugated metallic tubing provided at each of its extremities with fittings comprising split nuts, the separating surfaces of said nuts lying substantially in a common plane, and resilient extended members, each integrally connecting corresponding parts of said fittings at opposite extremities of said tubing and extending between points on the same side of said plane, said resilient members lying substantially in a plane diametric to said fittings and intersecting said separating plane, whereby to inhibit flexure of said tubing in a sense parallel to the plane containing said resilient members while enabling limited flexure in a sense normal to the same.

3. A flexible tubular structure comprising a section of corrugated metallic tubing having at each of its extremities coupling means comprising complemental split nut elements of substantially semi-circular formation and means for integrating said elements into coupled relation to said tubing, corresponding semi-circular portions of said coupling means being integrally interconnected by means of diametrically opposed resilient members non-deformable in a longitudinal sense, whereby to permit limited flexure of said tubing in a plane perpendicular to that containing said members and to inhibit flexure in said containing plane, and at the same time to inhibit deformation of said tubing under longitudinal stress.

4. In a differential-pressure-responsive measuring instrument, a casing, an element within said casing responsive to a differential pressure, a flexible tubular structure in said casing comprising a section of flexible metal tubing provided at its extremities with rigid fittings, one of said fittings being secured to a wall of said casing, means connecting the other of said fittings to said differential-pressure-responsive element for movement therewith, and means comprising members extending between said fittings and integrally secured thereto for enabling flexure of said tubing in a given plane to permit movement of the last-mentioned fitting with said differential-pressure-responsive element while inhibiting flexure of said tubing in other planes, said members also being longitudinally rigid to inhibit deformation of said tubing under longitudinal stress.

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Sept. 16, 1958 M. F. PETERS 2,852,216

REFUELING CONDUIT

Filed Sept. 16, 1954 2 Sheets-Sheet 1

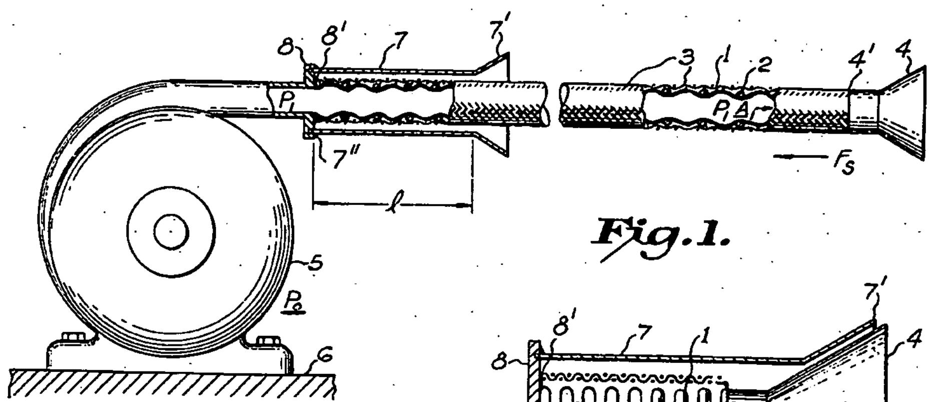

Fig. 1.

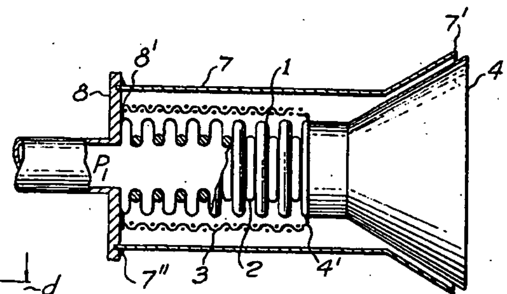

Fig. 2.

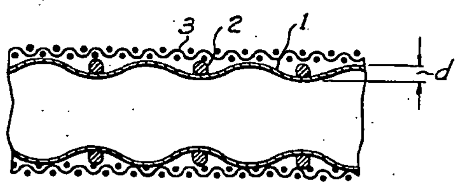

Fig. 3.

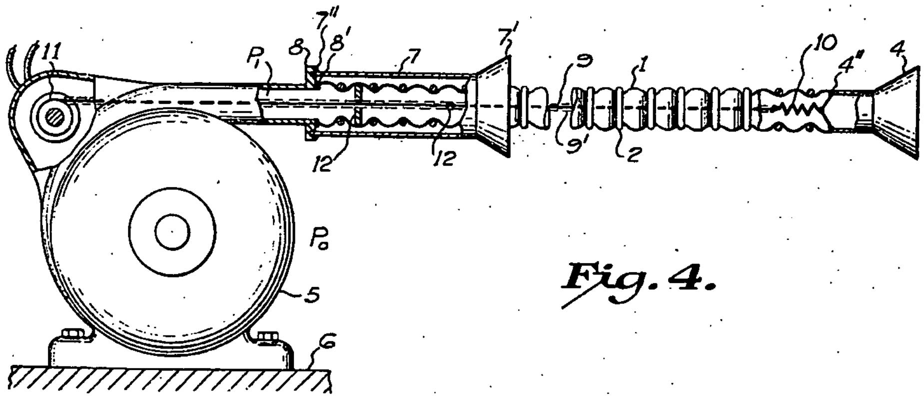

Fig. 4.

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REFUELING CONDUIT

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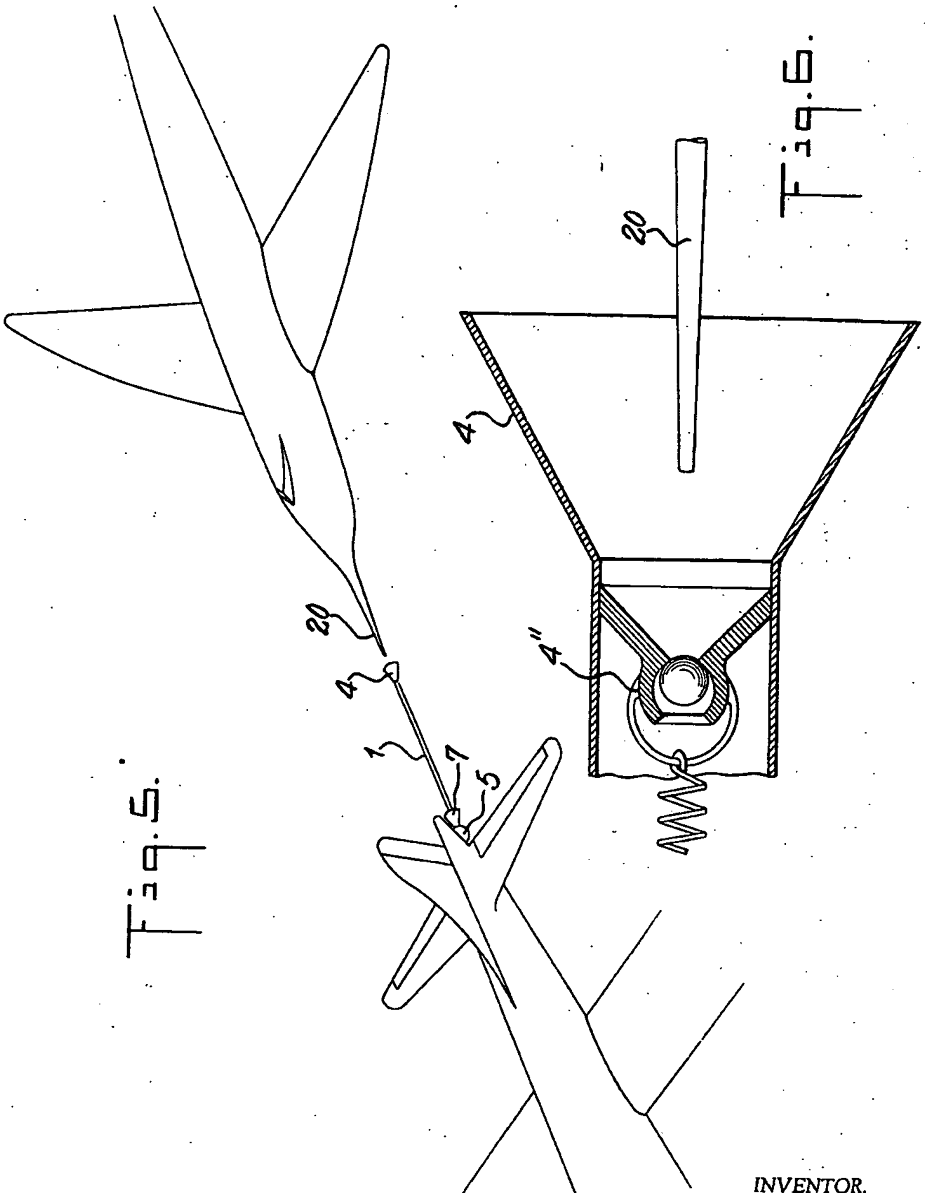

Fig. 5.

Fig. 6.

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United States Patent Office 2,852,216
Patented Sept. 16, 1958

2,852,216

REFUELING CONDUIT

Melville F. Peters, Livingston, N. J.

Application September 16, 1954, Serial No. 456,547
3 Claims. (Cl. 244—135)

This invention relates to retractable conduit and particularly to flexible retractable conduit for refueling airplanes in flight.

The conventional refueling system on a tanker consists of a storage tank, a pump to remove the fluid fuel from the tank and force it through a rigid tube to a rotary seal and a drum which is used to wind a flexible hose which forms a fluid tight passageway between the rotary seal and the drogue. During the process of refueling the receiver aircraft, a portion of the flexible hose trails the tanker and after the refueling operation is finished, the trailing portion of the hose is wound on a drum. To simplify the system it is the first object of the invention to substitute a retractable conduit for the flexible conduit, the rotary seal and the drum.

To eliminate the drum and rotary seal it is necessary to use a conduit which can be elongated. Such a conduit can be formed by using the conventional convoluted structure with an elastic braid and use the air stream and fuel pressure to elongate the hose. It is therefore a second object of the invention to use an elastic braid in combination with the forces of restitution of the tubing, which permit the conduit to elongate to a predetermined length without damage and when this length is reached, the algebraic sum of the forces produced on the trailing end of the conduit by the fluid pressure, the air stream, the elastic braid and the tubing shall equal zero. During the refueling operation the relative speed between tanker and receiver will be changing, so that it is a third object of the invention to provide sufficient elasticity in the conduit to allow extension and contraction of the conduit during the refueling operation. It is a fourth object of the invention to reduce the frictional losses of the fuel flowing through the hose by reducing the height of the convolutions when the hose is in the extended position. It is a fifth object of the invention to adjust the rate of flow in the convoluted conduit, so that the drop in pressure is within the range wherein the energy expended in cavitation losses is at or near a minimum.

When conditions make it impracticable to rely on the elastic properties of the braid and tubing to control the elongation of the conduit, a cable, chain, or cord passing through the conduit with one end attached to the drogue and the other end to the winch may be substituted for the elastic braid. It is therefore a sixth object of the invention to control the length of the retractable conduit by connecting one end of a cable, chain, or cord to the trailing end of the conduit and the other end of the connecting element to a winch which is controlled through a fluid, electric, or magnetic drive, so that the cord will exert a constant force on the drogue by winding or unwinding the cord on the drum of the winch when the pull on the cord becomes greater or less than a predetermined value during the refueling operation. It is a seventh object of the invention to keep the cable, chain, or cord in the center of the conduit by placing suitably shaped spindles along the cable. It is an eighth object of the invention to cover the element when it is a conductor of electricity with a protective coating, so as to prevent galling or chafing when the element contacts the conduit and when the protective coating is an insulator of electricity, it prevents a short circuit between the element and conduit when the connecting element is used to conduct electricity. It is a ninth object of the invention to place a spring in the cable, chain, or cord between the drogue and a section of the element which is not coiled on the drum of the winch, so that vibrations and shock waves will be modulated by the spring. It is a tenth object of the invention to use a spring in the restraining cord of the conduit to allow the conduit assembly to increase in volume when the flow of fluid is suddenly stopped. It is an eleventh object of the invention to increase the hoop strength of the conduit by putting wires or cords between the corrugations or convolutions of the conduit.

This invention is not limited to placing the controlling element within the conduit and it is a twelfth object of the invention to replace the cable, chain, or cord within the conduit by using two or more connecting elements outside the conduit.

In the drawings:

Figure 1 is a cross sectional view of a fluid delivery system consisting of a fluid pump, retractible conduit with braid and conduit having elastic properties, a valve at the free end of the conduit and a combination guide and receptacle for the hose, an embodiment of the invention.

Figure 2 is a cross sectional view of the hose in the retracted or compressed condition, supported and enclosed by the receptacle, an embodiment of the invention.

Figure 3 is a cross sectional view of a section of the hose in the extended condition, an embodiment of the invention.

Figure 4 is a cross sectioal view of a retractible fluid delivery system similar to the system shown in Figure 1, except the length of the hose is controlled by a cable, chain, or cord passing through the conduit, an embodiment of the invention.

Figure 5 is a view in perspective showing the manner in which the present fluid delivery system is attached to and used by aircraft.

Figure 6 is a cross-sectional view of the end of the fluid delivery hose showing the valve means contained therein on a somewhat enlarged scale.

The flexible conduit shown in Figure 1 consists of convolutions 1 when the conduit is formed from strip and corrguations when formed from tubing. The hoop strength of the convoluted conduit can be increased by winding wire or cord 2 in spiral form between the convolutions or by placing reinforcing rings between the corrugations of the corrugated tubing. In either type of construction the supporting elements 2 can be held in place by putting the wire or rings in grooves at designated sections of the conduit, or by molding, welding or soldering the supporting elements into place, since material can be either organic or inorganic and is unlimited in kind except by the operating conditions of the fluid system. The braid 3 has elastic properties and will retract the tubing to approximately the length L when the pump is not running and the pressure P_1 within the conduit equals pressure P_0 outside the conduit. When the pump is started the pressure P_1 becomes greater than P_0 and the tubing is elongated. As (P_1-P_0) is increased the trailing end of the conduit contacts the air stream, after which it is stretched until the forces produced by the air stream on the tubing and drogue together with the force $(P_1-P_0)A$ acting on the end of the tubing where A is the cross sectional area of the tubing, is equal to and opposite in direction to the force F_B produced by the spring action of the elastomer braid 3 and the spring

action of the tubing. When the relative rates of speed of tanker and receiver changes, the elastic properties of the braid compensates for the change in the relative position of the two airplanes. At 7 is shown a guiding conduit with one end supported at 8 and the other end flared to receive and support the drogue 4 when the pump is stopped and the pressure P_1 is equal to the pressure P_0. The conduit is attached to the drogue at 4' and to the pump 5 at 8'. A support for the pump is shown at 6.

Figure 2 shows the conduit in a compressed position which occurs when the pressure P_1 is equal to P_0 and the forces produced by the elastic properties of the braid are great enough to overcome the forces produced by the air stream acting on the conduit and drogue. The drogue 4 is resting and supported by the clamp holder 7'.

In Figure 3 the conduit is shown elongated until the depth of the convolutions or corrugations are reduced to remove the sharp edges at their bases so that the resistance to the flow of fluid through the conduit approaches the resistance to the flow of the fluid through a non-convoluted conduit.

The arrangement shown in Figure 4 is similar to the arrangement in Figure 1, except the cable, chain, or cord 9 can be used to control the extension of the conduit or position of the drogue when the forces produced by the air stream on the hose, or the weight of the hose, is so great that it becomes impractical to use the elastic properties of the braid and conduit to control the extension of the conduit. The hose 1 can be used with or without the protective braid 3 shown in Figure 1. When the hose is not in use the cable, chain, or cord is wound on the drum of the winch 11, so that the hose is compressed into 7 and the drogue 4 is supported by 7'. The winch 11 is coupled to the motor by a fluid, electrical, or magnetic drive, so that the tension on the connecting element can be held constant, or the stresses developed in the connecting element or reel can serve as a part of a control device by conducting the changes in stress to the power plant of the tanker, so that the output of the tanker power plant and consequently the speed of the tanker can be controlled by the stresses developed in 9 or 11. The protective coating 9' on 9 reduces the galling on the conduit when the centering beads 12 are not used and if the coating is an insulator of electricity it prevents a short circuit between 1 and 9 when the connecting element is used as a conductor of electricity. The spring at 10 permits the conduit to change in length when oscillations are set up in the probe, or to allow the conduit to elongate when the probe 20 is accidentally removed from the drogue during the refueling operation, so that it has the same effect in limiting the pressure in the conduit as a surge chamber in the drogue. The drogue valve 4" prevents the escape of fluid from the conduit 1 until the probe is inserted therein.

When the resistance to the flow of fluid through the conduit must be kept low, or the viscosity of the liquid is high, the drop in pressure through the conduit can be reduced by replacing element 9 by two or more elements outside the cable.

In the appended claims the word "cable" is intended to include a chain, cord, spring, or multiple units or combinations of such elements, and the words "convoluted conduit" are intended to include all known forms of conduits having corrugations, convolutions, beads, ribs, or other formations facilitating extension and retraction.

What is claimed is:

1. An apparatus for transferring fuel from one aircraft to a second aircraft equipped with a fluid receiving probe engageable with said apparatus, comprising a pump, inlet and outlet means on said pump, said outlet means including an extensible, flexible conduit attached at one end to the pump, said conduit being of a circular cross section that maintains a minimum internal diameter at all times, a layer of braid having elastic properties extending over the complete length of said conduit, a valve yieldably closing the free end of said conduit, said valve being operated by the probe of the second aircraft, and a rigid tubular support spaced from the free end of the conduit and secured to the pump to receive therein the flexible conduit when it is in the compressed position.

2. An apparatus for transferring fuel from one aircraft to a second aircraft equipped with a fluid receiving probe engageable with said apparatus, comprising a pump, inlet and outlet means on said pump, said outlet means including an extensible, flexible conduit attached at one end to the pump, said conduit being of a circular cross section that maintains a minimum internal diameter at all times, a layer of braid having elastic properties extending over the complete length of said conduit, a valve yieldably closing the free end of said conduit, said valve being operated by the probe of the second aircraft, a winch carried within the pump, a cable connected at one end to the winch and at its other end to the valve end of the conduit.

3. Apparatus according to claim 3 wherein the conduit is provided with a plurality of spaced spiders internally carried therein and the cable is slidably received through central openings in the spiders.

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VEHICLE MOUNTED BLOWER ASSEMBLY WITH HOSE AND SUPPORT BRACKET

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Fig. 1

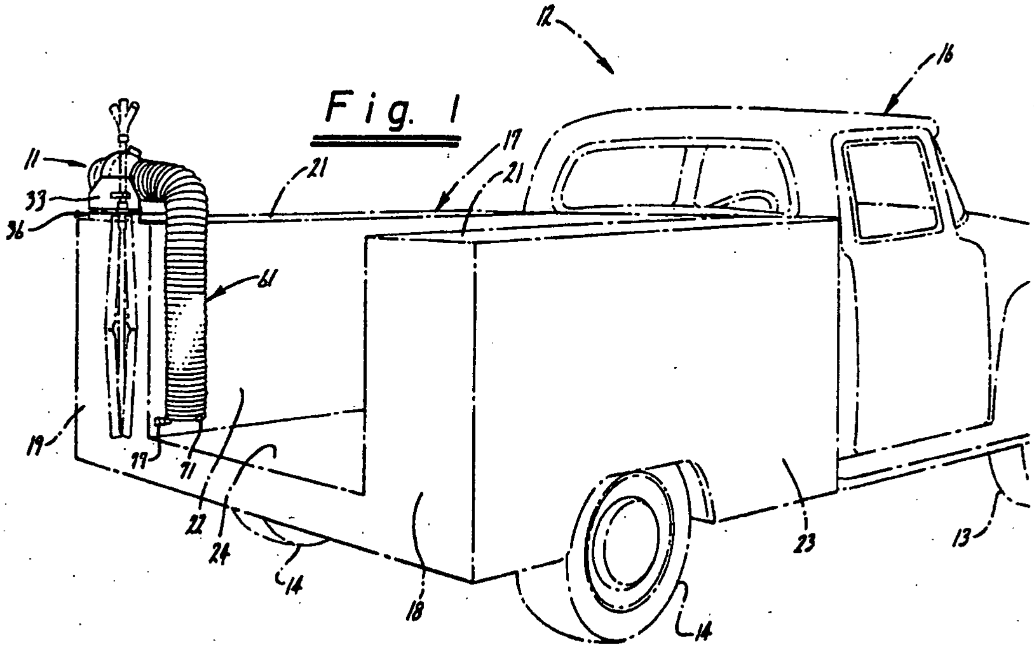
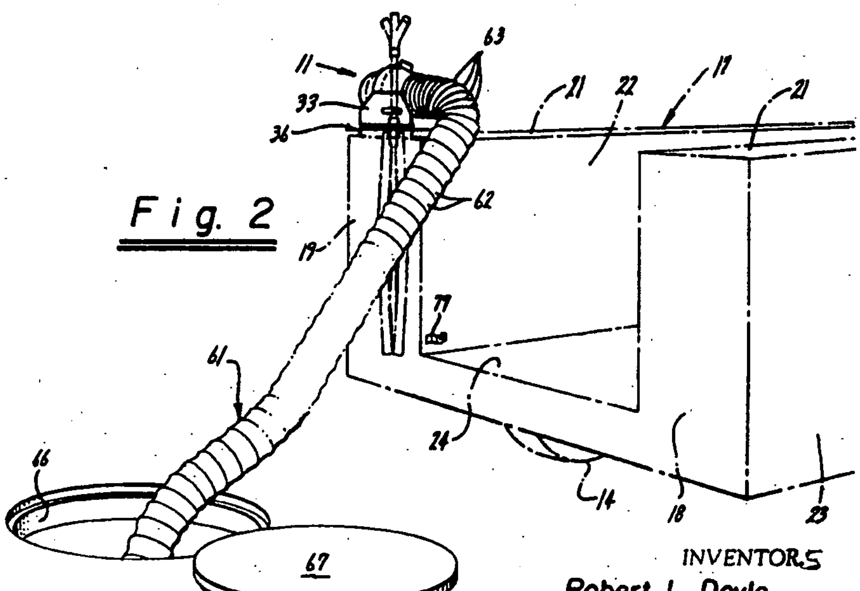


Fig. 2



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VEHICLE MOUNTED BLOWER ASSEMBLY WITH HOSE AND SUPPORT BRACKET

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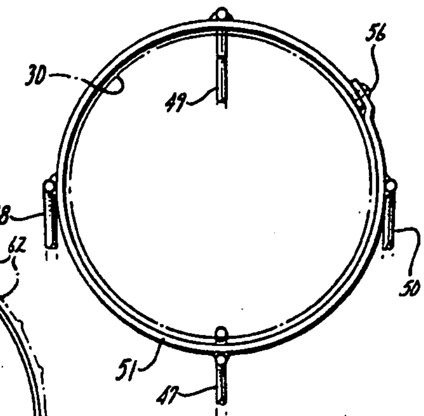


Fig. 4

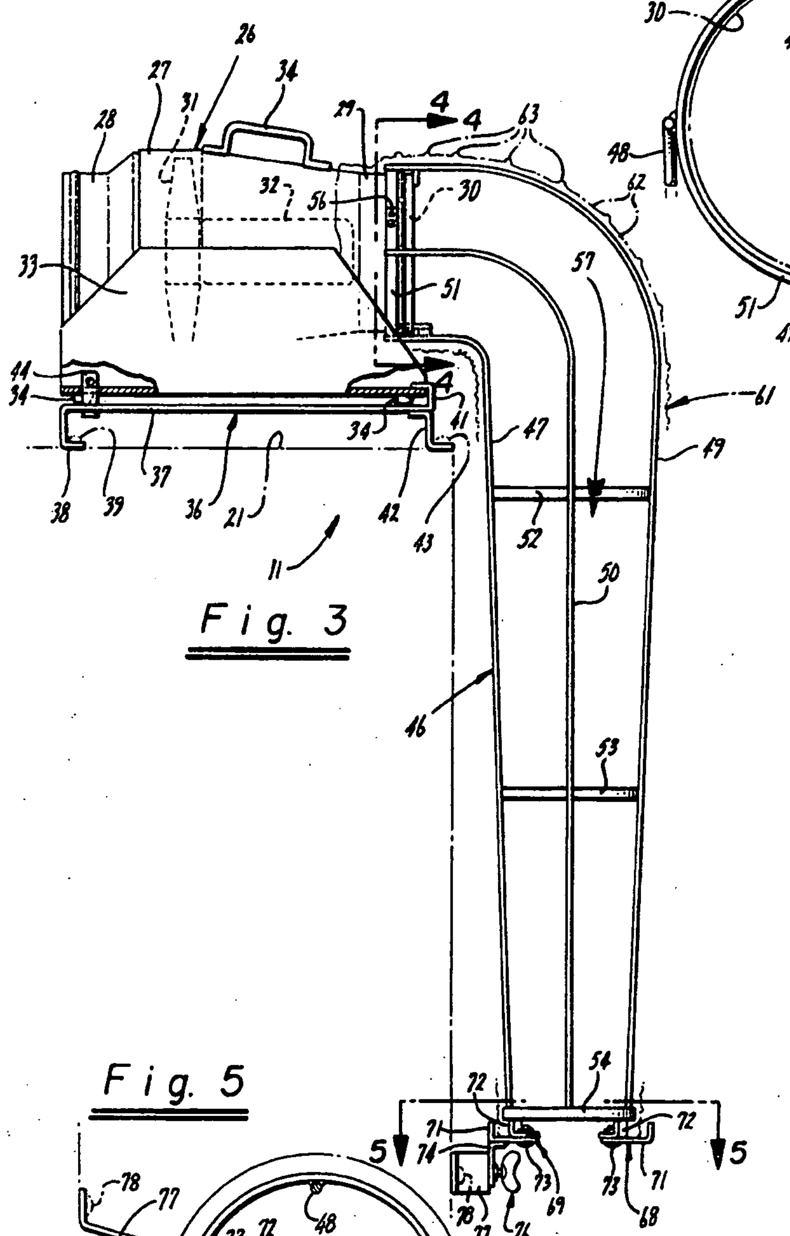
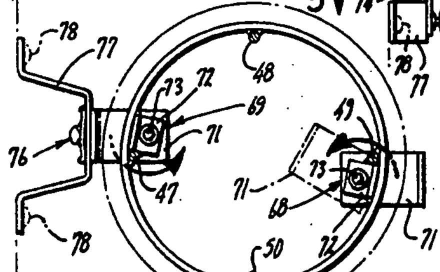


Fig. 3

Fig. 5



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3,467,301
Patented Sept. 16, 1969

3,467,301

VEHICLE MOUNTED BLOWER ASSEMBLY WITH HOSE AND SUPPORT BRACKET

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Filed Apr. 1, 1968, Ser. No. 717,495
Int. Cl. F04b *39/00*; B60p *3/30*
U.S. Cl. 230—235 7 Claims

ABSTRACT OF THE DISCLOSURE

Vehicle mounted blower assembly for manholes having a hose adapted to be inserted into the manhole and a bracket for supporting the hose in use and in storage positions.

Background of the invention

Blowers have heretofore been provided for the ventilation of manholes. However, heretofore, such blowers have been transported to the site on vehicles and then placed in a position alongside the manhole to ventilate the manhole. There is a need for a blower assembly of the type which can be mounted upon a vehicle and which can remain upon the vehicle when it is in use for ventilating the manhole. There is also a need for facilities on the vehicle for storing the hose utilized for ventilating the manhole when it is not in use.

Summary of the invention and objects

The vehicle mounted blower assembly with hose and support bracket consists of a blower assembly which includes a housing and has an outlet through which the air passes. A hose bracket is mounted on the housing for swivel movement on the housing. The bracket is formed of relatively rigid material and is generally L-shaped. The bracket has a substantially open passageway extending from the outlet in the housing to the other end of the bracket. The bracket has a passage which gradually decreases in cross-section in a direction towards the opening remote from the opening in the housing. A flexible collapsible hose is mounted on the bracket and is secured about the outlet opening in the housing. The other end of the hose is slidably mounted on said bracket and is adapted to be removed from the bracket and inserted into a manhole. The bracket is provided with retaining means for holding the hose in place on the bracket when it is not in use.

In general, it is an object of the present invention to provide a blower assembly with a hose and support bracket which is particularly adapted to be mounted on a vehicle and which can be utilized while it is on the vehicle.

Another object of the invention is to provide a blower assembly with hose and support bracket of the above character which can be readily placed into use.

Another object of the invention is to provide a blower assembly, hose and bracket of the above character which is relatively simple.

Additional objects and features of the invention will appear from the following description in which the preferred embodiment is set forth in detail in conjunction with the accompanying drawing.

Brief description of the drawing

FIGURE 1 is a perspective view of a blower assembly which includes a hose and a hose support bracket mounted upon a self-propelled vehicle which is shown in broken lines in which the hose is in a storage position.

FIGURE 2 is a perspective view showing the blower assembly shown in FIGURE 1 being used for ventilating a manhole.

FIGURE 3 is a side elevational view, partly in cross-section, of the blower assembly as shown in FIGURES 1 and 2 and showing the hose in broken lines.

FIGURE 4 is a cross-sectional view taken along the line 4—4 of FIGURE 3.

FIGURE 5 is a cross-sectional view taken along the line 5—5 of FIGURE 3.

Description of the preferred embodiment

The blower assembly **11** is mounted upon a self-propelled vehicle **12** of a conventional type; alternatively a trailer can be utilized. As shown therein, the vehicle **12** is provided with a chassis which includes front and rear wheels **13** and **14**. It also includes a cab **16** mounted over the front wheels **13** and a cabinet-like body **17** extending to the rear and mounted over the rear wheels. The body **17** is provided with two spaced vertical upstanding sections **18** and **19**, each of which is provided with a relatively planar top wall **21**, and inner and outer vertical side walls **22** and **23**. The body **17** also includes a horizontal platform **24** between the two sections **18** and **19** which is open to the rear.

As shown in the drawing, the blower assembly **11** is mounted upon one of the sections **18** or **19** and, as shown in FIGURE 1, is mounted on the left-hand section **19** on the top wall **21** adjacent the rear end of the top wall. The blower assembly **11** includes a blower **26** which is of a type described in copending application Ser. No. 580,246, filed Sept. 19, 1966, now Patent No. 3,401,869. As disclosed therein, the blower includes a venturi-shaped housing **27** that has a generally cylindrical inlet portion **28** and a generally cylindrical outlet portion **29** which forms an outlet **30**. A blower **31** is mounted within the housing and is driven by a motor **32** within the housing so that the fan causes the air to be drawn into the inlet portion and discharged from the outlet **30** of the housing **27**. The motor **32** is connected by a cord (not shown) to an electrical outlet (not shown) provided on the vehicle and connected to the battery supply in the vehicle or to an auxiliary generator or battery on the vehicle. The housing **27** is mounted in a U-shaped stand **33** and is also provided with a handle **34** to facilitate carrying of the blower assembly. The stand **33** is provided with resilient rubber feet **34**.

The blower assembly **26** is mounted upon the vehicle **12** in a suitable manner. For example, as shown in the drawings, a stand or bracket **36** can be provided. This stand **36** consists of a member **37** which is provided with a U-shaped portion **38** at one end which is secured to the vehicle **38** by suitable means such as rivets **39**. The member **37** is also provided with a U-shaped portion **41** at its other end which faces in an opposite direction from the U-shaped portion **38** and is provided on the opposite side of the member **37** so that it is positioned above the top surface **21** of the section **19** of the body **17**. The other end of the member **37** is secured to the top wall **21** by a generally Z-shaped member **42** which has one end secured to the body by suitable means such as rivets **43** and has the other end secured to the member **37** by suitable means such as welding.

As can be seen, the stand **33** of the blower assembly **26** is open at both ends and this permits one end of the bottom wall of the stand **37** to be inserted underneath one portion of the U-shaped portion **41** of the member **37** to hold it in place. The other end of the stand **33** is secured to the stand **36** by suitable means such as a quick-release fastener **44** of a conventional type. With this construction it can be seen that the blower assembly **26** can be readily inserted on the stand **36** and also can be readily removed from the stand **36**.

A hose support bracket 46 is mounted upon the blower assembly 26. The hose support bracket 46 is generally L-shaped as shown particularly in FIGURE 3 and consists of four elongate members in the form of rods 47, 48, 49 and 50 which generally have an L-shaped form and which are arranged approximately 90° apart to generally circumscribe a circle in cross-section but one which gradually decreases in diameter from one end of the bracket to the other. A plurality of rings 51, 52, 53 and 54 are provided which are spaced longitudinally of the rods 47, 48, 49 and 50 and serve as spacers for the rods. As can be seen, the spacer ring 51 is provided at the large end, whereas the rings 52 and 53 are disposed between the large and small ends. The ring 54 is provided at the small end of the hose support bracket.

The ring 51 is split to permit its placement over the outlet end portion 29 of the blower assembly and to permit the same to be fastened thereon by suitable means such as a screw 56 to permit swivel or pivotal movement of the hose support bracket 46 upon the housing of the blower assembly. As can be seen, the hose support bracket is provided with a passage 57 which extends from the outlet of the blower assembly longitudinally of the hose support bracket out through the small ring 54 provided at the other end of the hose support bracket. The passage 57 gradually decreases in size from the inlet to the outlet.

A hose 61 of a generally conventional construction is mounted upon the hose support bracket. The hose 61 is formed of a flexible, relatively impervious material 62 and is provided with a plurality of relatively rigid rings 63 spaced longitudinally of the hose and incorporated into the material 62 forming the hose by suitable means such as sewing so as to generally retain the cylindrical shape desired for the hose. The rings 63 have a diameter which is only slightly greater than the largest cross-sectional dimension of the hose support bracket 46 so that it is adapted to be slid over the hose support bracket and then over the outlet portion of the housing of the blower assembly and fastened thereto by suitable means such as a strap which clamps one end of the hose about the outlet portion of the housing. As shown in FIGURE 2, the hose 61 is constructed so that it has a length which is sufficient to reach down into a manhole 66 as shown in FIGURE 2 from which the manhole cover 67 has been removed. The hose 61 is of a type which can be collapsed and, therefore, can be pushed onto the hose support bracket 46 and stored completely on the hose support bracket as shown in FIGURE 1.

Means is provided on the hose support bracket for retaining the hose in a stored position on the bracket and consists of a pair of clamps 68 and 69 which are mounted upon the lower extremity of the hose support bracket 46. The clamp 68 consists of an L-shaped member 71 which is pivotally connected to another L-shaped member 72 by a bolt 73. The member 72 is secured to the ring 54 by suitable means such as welding. The other clamp 69 also includes L-shaped members 71 and 72 which are pivotally interconnected by a bolt 73. In addition, the L-shaped member 71 of the clamp 69 has another L-shaped member 74 secured thereto by suitable means such as welding and which is provided with a quick-release fastener 76 of a conventional type which is adapted to secure the bracket 69 to a bracket-like member 77 secured to the side wall 22 of the section 19 by suitable means such as rivets 78.

Operation and use of the blower assembly with the hose support bracket and hose may now be briefly described as follows. Let it be assumed that the blower assembly hose support bracket and the hose are in a position shown in FIGURE 1 in which the hose is in a stored position. Also, let it be assumed that the self-propelled vehicle 12 is driven to a location and it is desired to ventilate a manhole 66. To remove the hose from the bracket, it is merely necessary to lift the hose by one hand so that it clears the clamps 68 and 69 and then the quick-release fastener 76 is operated to release it from the member 77. Thereafter, the L-shaped members 71 of both the clamps 68 and 69 are pivoted inwardly as shown in FIGURE 5 so that they do not extend beyond the outer margins of the lower ring 54. After this has been accomplished, the support bracket is swivelled slightly by pulling the lower end of the hose support bracket rearwardly so that as the hose is permitted to drop off of the bracket, it will clear the platform 24. As the hose drops off the bracket, it extends and can be lowered into the manhole. As soon as this has been accomplished, the blower motor 32 can be energized to place the blower in operation. The blower can operate in either of two ways: it can either draw fresh air and force it down into the manhole, or it can suck air out of the manhole depending upon the direction of rotation of the motor for the blower. Since the bracket 46 is open between the rods 47, 48, 49 and 50, the bracket 46 does not interfere in any substantial way with the movement of air through the hose 61.

It can be seen that with this arrangement a manhole can be quickly and readily ventilated merely by backing the truck up to the manhole and then quickly releasing the hose and lowering it into the manhole. After the work in the manhole has been completed and it is no longer desired to ventilate the same, the hose can be removed from the manhole and collapsed and pushed upwardly onto the hose support bracket 46 until the lower extremity of the hose clears the lower extremity of the hose support bracket. Thereafter, the L-shaped members 71 are rotated outwardly. At the same time, the hose support bracket can be swivelled inwardly and the quick-release fastener 76 secured in place so that the hose support bracket is firmly supported and at the same time the hose is retained upon the hose support bracket.

It can be seen that during all times the hose 61 is supported by the support bracket, whether it is in use or during the time it is in storage. This is particularly true with respect to the right-angle bend which is formed by the hose. This right-angle bend is always supported by the hose support bracket to prevent the collapse of the hose.

It also can be seen that the hose is mounted in such a manner that it is protected within the body of the self-propelled vehicle. It also can be seen that, if desired, the blower assembly 26 can be readily removed from the vehicle and used on the ground.

It is apparent from the foregoing that there has been provided a blower assembly with a hose support bracket and hose which has many advantageous features and which is particularly adapted for mounting on a vehicle so that it can readily be put into use and can be taken out of use.

We claim:

1. In an assembly of the character described, a blower assembly including a housing and having an outlet through which air passes, a hose bracket mounted on said housing and means for swivel movement of said hose bracket on said housing, said bracket being formed of relatively rigid material and being generally L-shaped, said bracket having a substantially open passageway extending from the outlet in the housing longitudinally through the hose support bracket, said hose support bracket having a gradually decreasing lateral cross-section extending longitudinally of the hose support bracket from the end connected to the housing to the outlet end, a flexible collapsible hose mounted on said hose support bracket and secured to the outlet end of the housing, the other end of the hose being slidably mounted on the support bracket and being removable therefrom so that the hose can be extended.

2. An assembly as in claim 1 together with a vehicle, and means for removably mounting said blower assembly on said vehicle with said hose support bracket and said hose mounted thereon.

3. An assembly as in claim 1 together with means mounted on said hose support bracket for retaining said hose thereon, said retaining means being movable to a position to permit the end of the hose adjacent thereto to be removed therefrom.

4. An assembly as in claim 1 wherein said hose support bracket includes a plurality of relatively rigid elongate members extending longitudinally of the hose support bracket and a plurality of spacer members secured to said elongate members and being spaced longitudinally of the elongate members.

5. An assembly as in claim 2 together with means for securing said hose support bracket to said vehicle.

6. An assembly as in claim 4 wherein there are at least four of said elongate members and wherein said four members are spaced substantially 90° apart.

7. An assembly as in claim 4 wherein one of said

spacer members is split to permit the same to be fastened over the outlet end of the housing and means for removably securing said spacer to said housing to permit pivotal movement of the bracket.

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HENRY F. RADUAZO, Primary Examiner

U.S. Cl. X.R.

137—344, 355.16; 230—120, 132

United States Patent

[11] 3,623,500

[72] Inventor Donald D. Hoy
P.O. Box 197, Highland, Mich. 48031
[21] Appl. No. 888,619
[22] Filed Dec. 29, 1969
[45] Patented Nov. 30, 1971

[54] FLUID CONDUIT CONTROL
3 Claims, 10 Drawing Figs.

[52] U.S. Cl. 137/344, 137/615
[51] Int. Cl. B05b 9/02
[50] Field of Search 137/344, 354, 355.16, 355.2, 615

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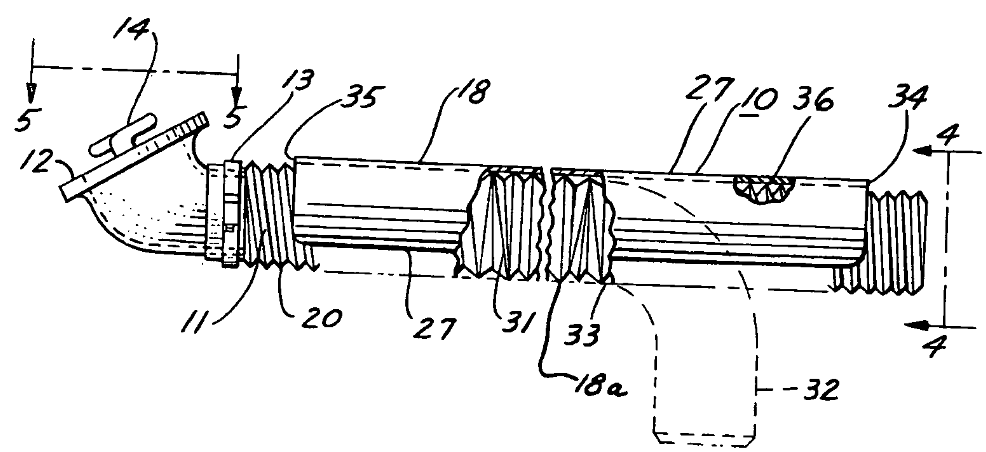
Primary Examiner—Samuel Scott
Attorney—Gerald R. Hershberger

ABSTRACT: My invention provides a selectively adjustable, flexible, expandable and rigid fluid conduit control for aboveground carrying off of fluids, liquids or other matter. The device may be connected to portable houses such as travel trailers, campers, truck campers, or motor homes for carrying off liquids or other waste matter from such houses.



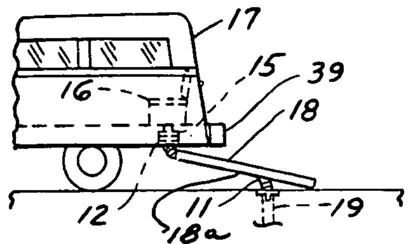


FIG. 1

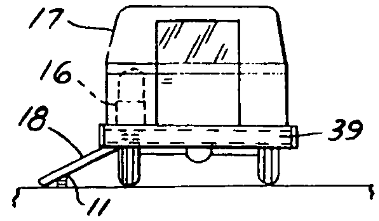


FIG. 2

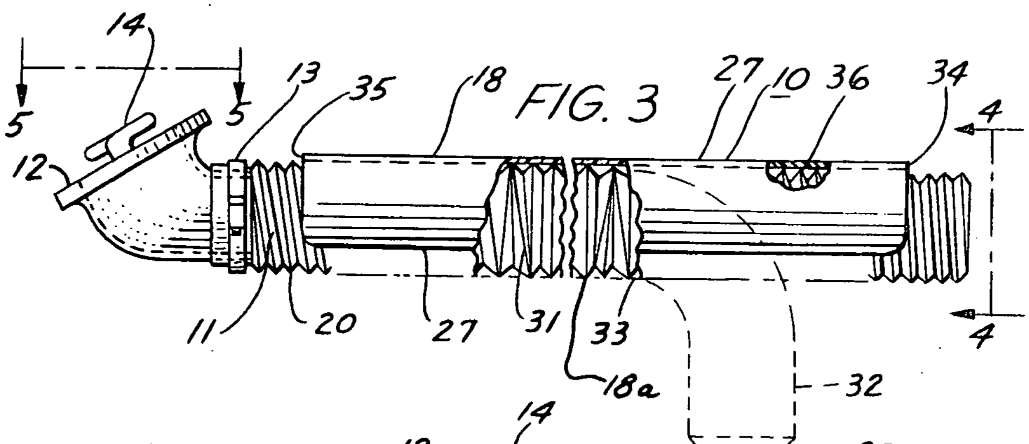


FIG. 3

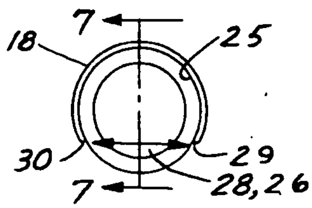


FIG. 4

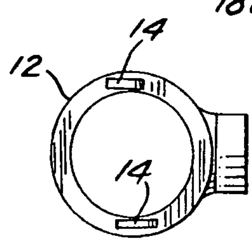


FIG. 5

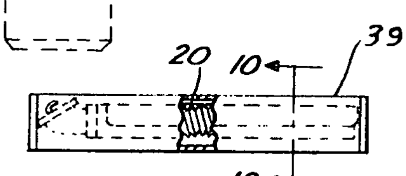


FIG. 9

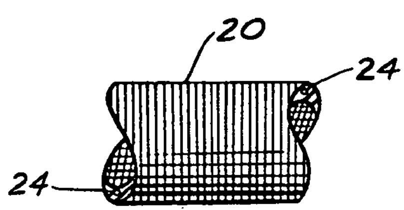


FIG. 6

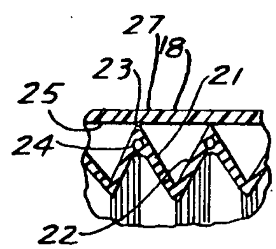


FIG. 7

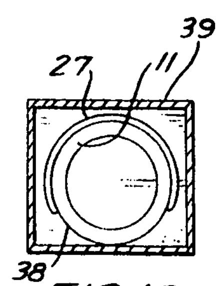


FIG. 10

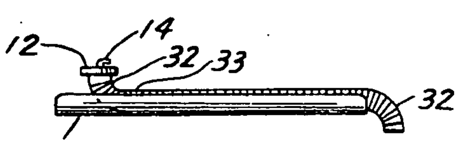


FIG. 8

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FLUID CONDUIT CONTROL

BACKGROUND OF THE INVENTION

1. Field of the Invention

My invention relates to a fluid conduit control, and more particularly to a fluid conduit control which is attached to a portable or mobile house for carrying off liquids or waste matter from such house to a sewer or septic tank.

2. Description of the Prior Art

There is at least one device which has been marketed during recent time for use as a sewer outlet for portable houses, such as a flexible hose connected to said house and mounted on inclined ground-supported ramp to maintain an incline in the hose. This has the disadvantage for most owners that it is cumbersome and unwieldly to handle, does not store easily and is subject to damage or rupture. The present invention provides an aboveground sewer conduit for portable homes which has a self-sustaining incline for proper drainage, and which is compact, is easily stored, and protected from damage or rupture.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a fluid conduit control comprising a body which is flexible and expandable and contractable in accordionlike manner having openings at both of its ends, and which is carried by a substantially rigid lightweight semitubular shell, which shell restricts the expansion and contraction of the body within the limits of the shell and permits the body to be selectively extended manually from such shell at selected points along the length of such shell.

It is a further object of this my invention to provide a fluid line control which comprises a portable house offal tank having an outlet, a fluid conduit body which is flexible, and expandable and contractable in accordionlike manner having one end thereof connected in fluid relationship to such outlet which body is carried or supported inside an elongated semitubular substantially rigid shell which restricts and limits the expansion and contraction of the body therein, and permits the body to be extended from such shell at selected points along the length of such shell.

It is another and further object of this my invention to provide a fluid control for an offal or refuse tank with outlet mounted above ground level in a portable house. The outlet is connected in fluid relationship with a conduit body which is flexible, expandable and contractable lengthwise in accordionlike manner, the conduit body being held straight by a semitubular substantially rigid plastic shell which restricts and limits the contraction and expansion of the body within such shell, and permits such body to be extended from such shell at selected points along the peripheral length of such shell for connection to an underground sewer.

It is a further object of my invention to provide for convenient storage of the fluid control unit on a portable house.

It is a further object of my invention to provide protection against rupture or damage of the fluid conduit.

BRIEF DESCRIPTION OF THE DRAWING

The present invention may be better understood and numerous other features and advantages thereof will become apparent to those skilled in the art by reference to the accompanying drawing wherein the like reference numerals refer to like elements in the various figures in which:

FIG. 1 is a side view of a portable house or trailer showing the sewerage control system installed thereon.

FIG. 2 is a back view also showing the sewerage control system installed thereon.

FIG. 3 is a side view of the fluid conduit control.

FIG. 4 is an end view of the fluid conduit control taken in direction of arrows 4—4.

FIG. 5 is a plan view of the attachment shown in FIG. 3.

FIG. 6 is a view of a partial section of the conduit in compressed outline.

FIG. 7 is a sectional view showing details of construction taken along lines 7—7 of FIG. 4.

FIG. 8 is a side view showing another position or arrangement of the conduit control.

FIG. 9 is a view showing the fluid conduit control stored in the bumper of the vehicle.

FIG. 10 is a sectional view taken along line 10—10 of FIG. 9 showing the storage arrangement of the fluid conduit control.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in detail to the drawing and in particular to FIGS. 1—2 and 3, the fluid conduit control is denoted generally by the numeral 10 and is shown as including a conduit body 11, a refuse tank connector 12, and a clamping means 13 for securing said connector to said conduit body and a semitubular shell 18, for supporting said body 11. As shown in FIG. 3, said connector has a bayonet-type lock portion 14 which is fastened to the offal or refuse tank outlet 15, the offal tank or refuse tank 16 being mounted above ground in the portable house 17. As shown in FIGS. 1 and 2, said tank is aboveground and said conduit body is thereby held on an incline with respect to the ground and biased against flexing at its center portion 18a by said rigid semitubular shell, the end of said conduit body opposite the tank being usually inserted into a sewer inlet 19 which is a ground level, to cause said incline and resulting in positive flow of fluids from said tank to said sewer inlet.

As shown in FIGS. 3, 4, 6, 7 and 8, said conduit body 11 is comprised of a flexible, elongated, hollow, generally tubular pleated portion 20 having walls 21 folded inwardly 22 from the outside periphery thereof to define peaklike circular vertexes 23 at the outside periphery of which vertex is fastened or contained an annular spring elongated wire coil 24. Said coil is spaced to provide expansion and contraction of the conduit body 11 in accordionlike manner when said coil is compressed or expanded. The said conduit body 11 is thereby expanded to an overall length several times its compressed length as shown in FIGS. 6 and 8. Referring to FIGS. 1, 2, 3, 4 and 7, the shell 18 is shown as controlling and supporting the body 11, and is defined as being elongated and semitubular, with generally thin plastic walls 25 preformed to provide a generally wide elongated gap 26 along the entire peripheral length 27 of said shell. The width 28 of said gap is so constructed that the edges 29 and 30 thereof spread or spring open and contract in response to manual pressure upon insertion and removal of said conduit body vertexes into said shell gap and thereby exerts force or pressure on said vertexes and conduit body 11 to manually releasably secure the conduit body vertexes 23 into selective various expanded or contracted rigid configurations 31 within said shell and to manually releasably permit the operator to extract a selected flexible free length 32 of said conduit pleated portion through said shell gap at any point 33 along said gap while such free length remains connected to a portion of said conduit body which is held rigid and fixed inside said shell.

As disclosed in FIGS. 3 and 8, the conduit body is shown in varied relationship to the controlling shell 18, such as extending out both ends 34 and 35 of said shell or being mounted on top 36 or bottom 37 thereof, or said conduit body may be extended from said shell short of end 34 of said shell to accommodate various conditions met in connecting to said sewers, since the sewer connections in trailer parks or the like are not uniform as to location.

Referring to FIGS. 1, 2, 9 and 10 a preferred means of storing the conduit control is disclosed. Many trailers have a hollow rear bumper 39 for storage of soil pipe conventionally used for a sewer connection in trailer parks and the like, and the compact design of this instant invention, namely the outside diameter 38 and length thereof, which is only slightly larger than the diameter of the required conduit used for sewerage disposal purposes in the cited cases and the length of said shell is constructed shorter than said bumper

mits the conduit to be compressed completely into said shell, and the said shell to be completely contained lengthwise inside said trailer bumper for traveling.

While a preferred embodiment has been shown and described, various modifications and substitutions may be made without departing from the spirit and scope of the present invention. Accordingly, the present invention has been described by way of illustration and not limitation.

What is claimed is:

1. In a fluid control, the combination of fluid conduit means including an elongated conduit member having a hollow generally tubularly outlined accordion-walled portion which walled portion is contractable axially, expandable axially and bendable axially in its free state,

and combined clamping and supporting means including a generally elongated, substantially rigid longitudinally, wall clamping and supporting member having a gripping element operable to releasably engage said accordion-wall portion to selectively secure said wall portion in temporarily substantially rigid fluid passage relationship longitudinally with respect to said clamping and supporting member and to temporarily fix said accordion-walled portion to a selected stretched size longitudinally in contained relationship with said wall clamping and supporting member.

2. In a fluid control system, the combination of, a portable ground supported house offal tank having an above ground outlet, fluid control means including an elongated, generally flexible annular fluid passaged generally tubular accordion-walled section, which section is contractable, expandable, and bendable axially in its free state, said section having an end thereof connected in fluid carrying relationship to said outlet,

And holding and clamping means connected to said conduit fluid control means between said outlet and the ground including a generally elongated resilient clamping and holding wall section substantially rigid axially and biased radially to releasably exert manually responsive tension across the peaks of said accordion-walled section to hold at least a substantial portion of said accordion-walled section substantially rigid, substantially straight, to a selected size lengthwise, and at a substantial incline with respect to the ground to facilitate substantially increased drainage flow from said tank outlet through said conduit accordion-walled section.

3. In combination with a portable ground carried house having an offal tank mounted therein including an aboveground offal tank outlet associated with said tank, an offal fluid disposal control, comprising,

fluid conduit means including an elongated flexible generally tubular resilient accordion-walled section having peaks and pleats contractable and expandable to various lengths axially, and having an end thereof connected to said outlet in fluid carrying relationship,

And clamping and supporting means including a generally elongated resilient clamping and supporting semitubular wall section generally rigid in bending and biased circumferentially to exert tension on said peaks of said conduit accordion-walled section to hold at least a substantial portion of said accordion-wall section self-supporting, rigid, of a selected size longitudinally, substantially straight, and in an inclined relationship axially with respect to the ground to substantially increase drainage flow from said tank through said conduit accordion-wall section.

* * * * *

United States Patent [19]

Otto

[11] **3,712,331**

[45] **Jan. 23, 1973**

[54] **HOLDING TANK EVACUATING APPARATUS FOR A RECREATIONAL VEHICLE**

[76] Inventor: **Carlos F. Otto**, P.O. Box 283, Lander, Wyo. 82520

[22] Filed: **March 3, 1971**

[21] Appl. No.: **120,626**

[52] **U.S. Cl.** **137/355.16**

[51] **Int. Cl.** **B65h 75/36**

[58] **Field of Search**....137/351, 354, 355.16, 355.18, 137/355.2, 355.24, 355.26, 355.28, 615, 604

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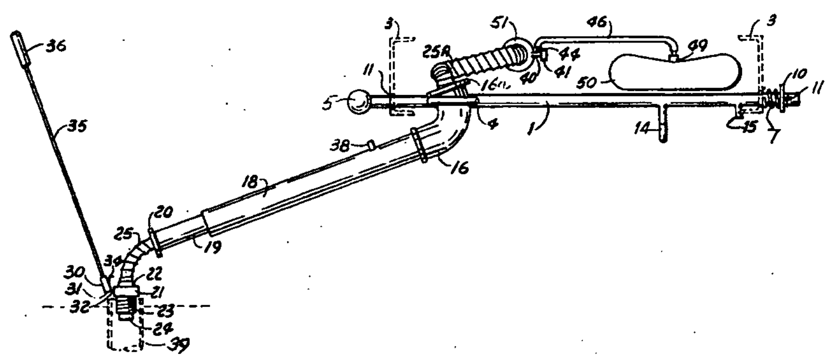
Primary Examiner—Samuel Scott
Attorney—Watts, Hoffmann, Fisher & Heinke

[57] **ABSTRACT**

Apparatus for evacuating the holding tank of a recreational vehicle including a flexible hose and a carrier rotatably attached to the vehicle and a rigid sleeve for supporting the hose at all times.

12 Claims, 12 Drawing Figures



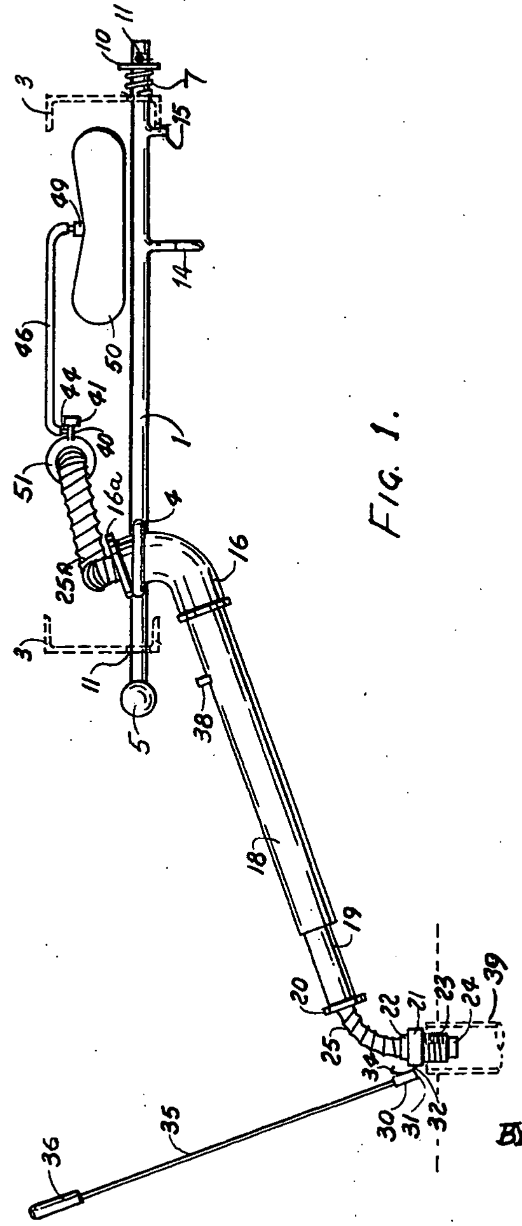


FIG. 1.

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BY Watts, Hoffmann,
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PATENTED JAN 23 1973

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SHEET 2 OF 4

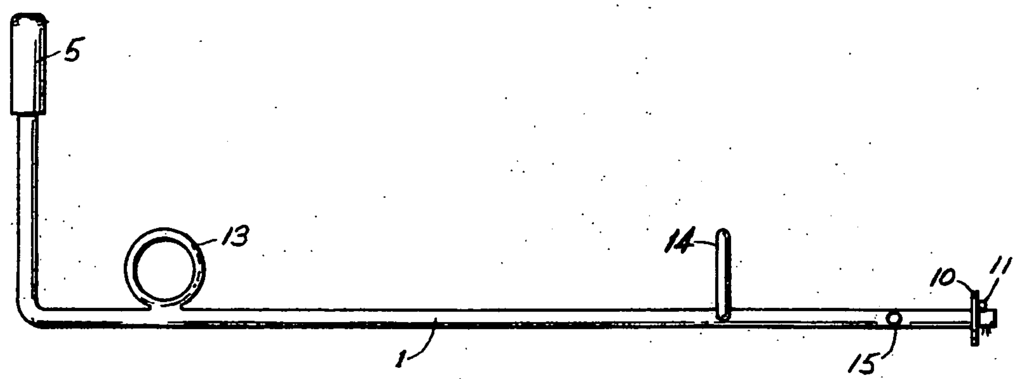

FIG. 3.

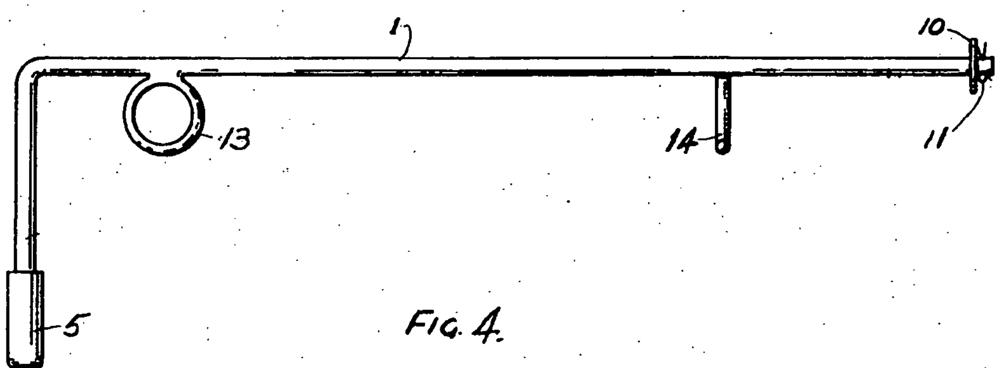

FIG. 4.

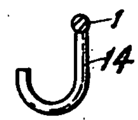

FIG. 5.

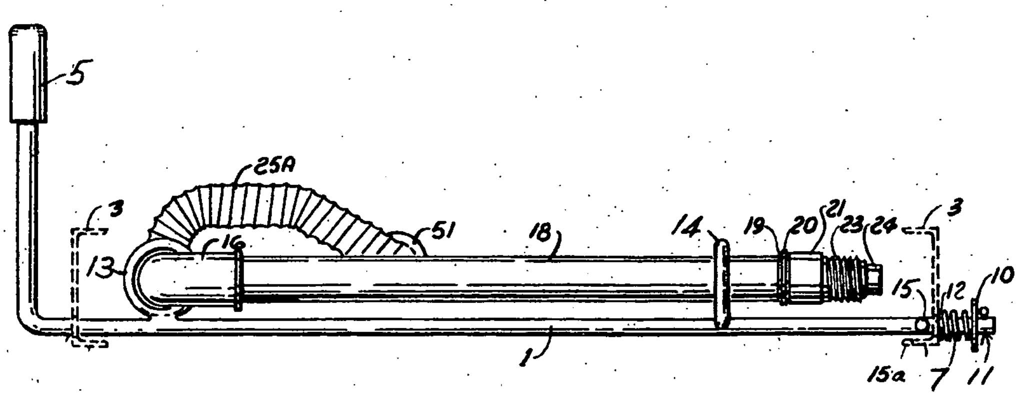

FIG. 2.

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BY Fisher & Heinke

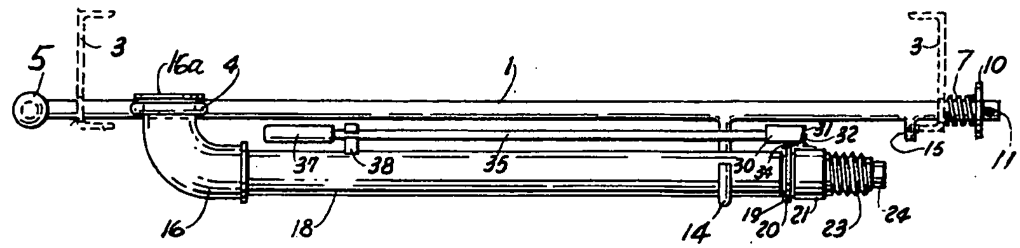

FIG. 6.

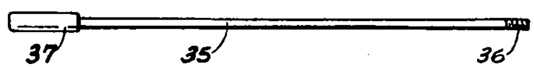

FIG. 7.

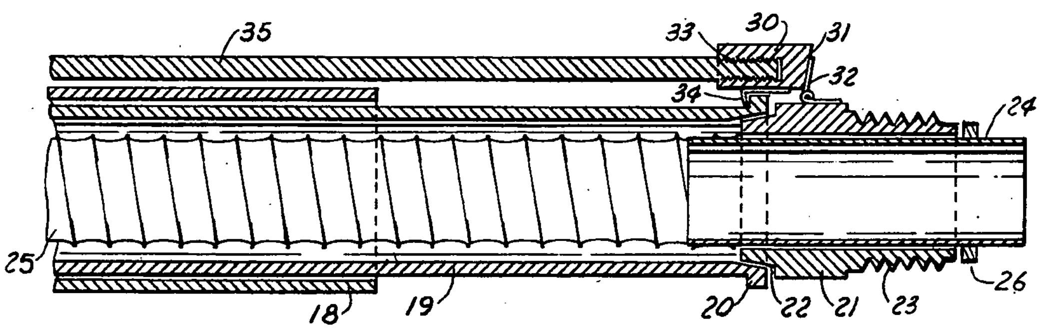

FIG. 8.

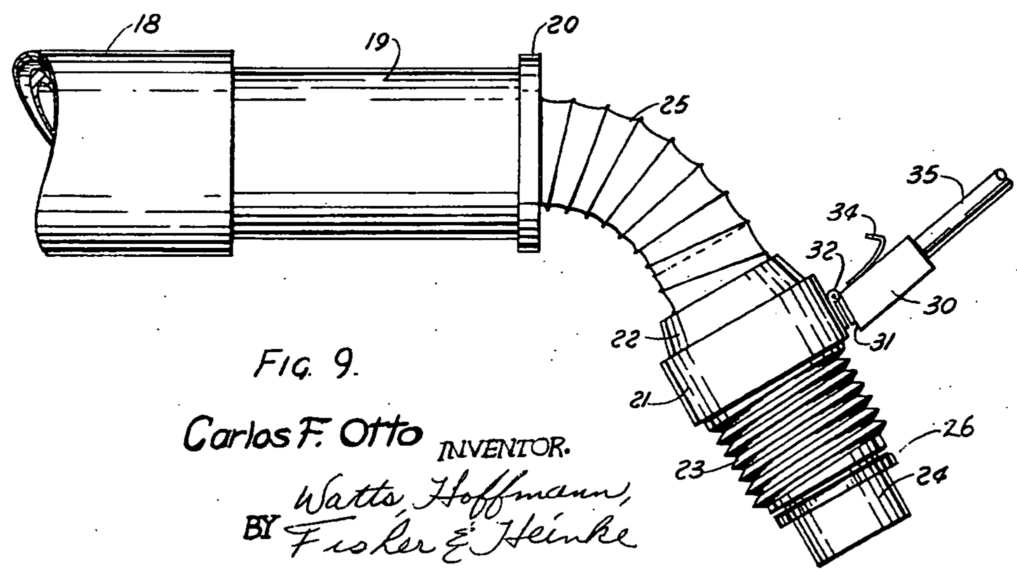

FIG. 9.

Carlos F. Otto INVENTOR.

BY Watts, Hoffmann, Fisher & Heinke

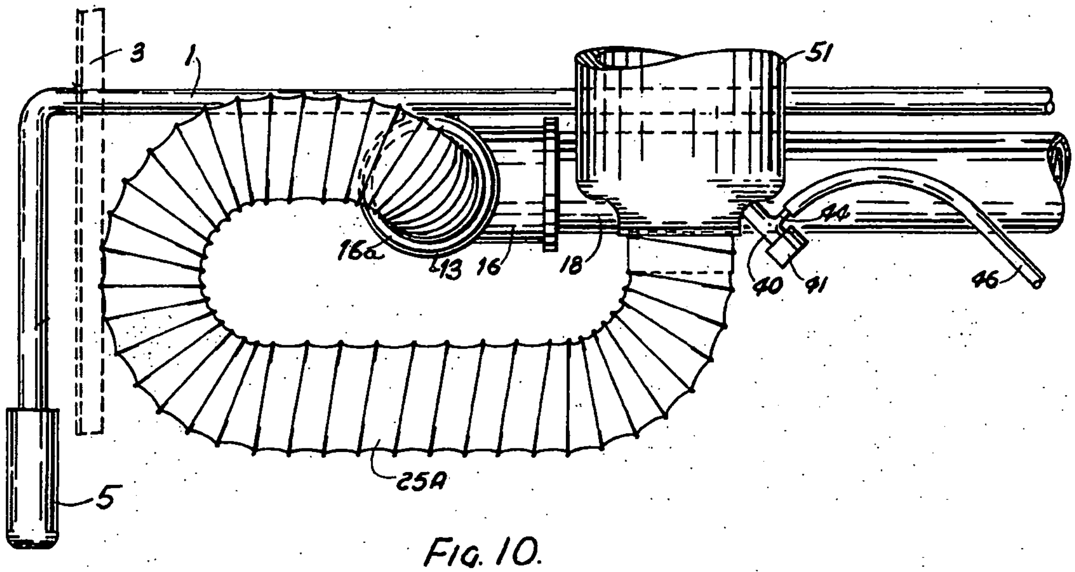

FIG. 10.

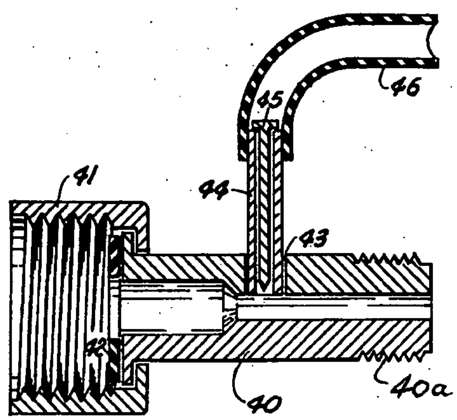

FIG. 11.

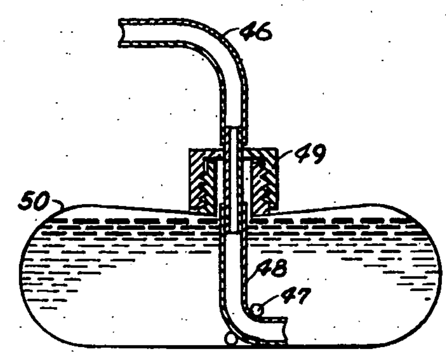

FIG. 12.

Carlos F. Otto INVENTOR.

BY Watts, Hoffmann, Fisher & Heinke

HOLDING TANK EVACUATING APPARATUS FOR A RECREATIONAL VEHICLE

BACKGROUND

Prior to this invention it has been the practice for each recreational vehicle equipped with a holding tank to carry a suitable drain hose. The hose had a fitting on one end to connect with the outlet of the tank and another fitting on the other end to connect with a sewer or dump station. The hoses were quite flexible and it was necessary to provide suitable supports at close intervals to maintain a downward slope of the hose from the tank to the hose outlet. The supports varied from crude bricks and stones to various forms of wire or metal brackets. In all of the various arrangements it has been the practice to disconnect the hose from the tank, collect the supports, and store the loose parts in a container or elsewhere each time the vehicle was moved. There has been a need for a satisfactory apparatus to provide for a hose that could remain connected to the tank at all times and that could be quickly and easily cleansed and disconnected from the sewer facility and that could be securely and easily stored during movement of the vehicle.

SUMMARY

This invention concerns apparatus for evacuating the sewage contents of a holding tank of a recreational vehicle. The apparatus provides a simple and satisfactory means of storing an extensible accordion type drain hose during transit without disconnecting the hose from the tank. The apparatus completely eliminates the usual troubles and problems encountered in cleaning, disconnecting and storing such a hose and associated fittings each time the vehicle is moved to a new location. The apparatus also provides a rigid support having a fixed gradient for the full length of the hose when the outlet end is connected to a sewer or dump station.

Thus it is an object of the present invention to provide a safe, simple and sanitary means to evacuate the sewage contents of the holding tank of recreational vehicles.

It is a further object to provide a compact, protective and secure storage means for a recreational vehicle corrugated expansible type sewer hose while in transit.

It is a further object to provide means for a rigid support having a continuous gradient for a sewer hose when evacuating the contents of a holding tank.

It is a further object to provide an improved means to evacuate a holding tank to a sewer facility at various locations with respect to the vehicle.

It is a further object to provide an effective means to flush and cleanse the vehicle sewer hose and fittings after evacuation of the holding tank to destroy harmful bacteria and odors without disconnecting the hose from the holding tank.

It is also an object to provide a means to provide for a water rinse through the hose prior to flexing and movement of the hose in freezing weather to prevent cracking of the hose.

Other advantages and benefits of the present invention will be apparent from a consideration of the drawings in which:

FIG. 1 is an elevation view showing a typical position of the apparatus connected to a sewer or dump station;

FIG. 2 is an elevation view of the rotatable carrier rack when the rack is in the raised position for travel;

FIG. 3 is an elevation view of the rotatable carrier rack when the rack is in the raised position;

FIG. 4 is a plan view of the rotatable carrier rack in the lowered position;

FIG. 5 is an end sectional view of the rotatable carrier rack;

FIG. 6 is an elevation view of the rotatable carrier of FIG. 2 in a lowered position between travel and discharge positions;

FIG. 7 is a side view of the handling and positioning rod of FIGS. 1 and 6;

FIG. 8 is a fragmentary, partly sectional view of the flexible hose and the telescoping tubes of FIG. 1;

FIG. 9 is a fragmentary side elevation view of parts of FIG. 8 with the inner telescoping sleeve partially extended, the hose projecting from the sleeve, and the positioning rod connected to the end of the hose;

FIG. 10 is a fragmentary plan view of parts of FIG. 1 including the connection to the holding tank fitting of a source of disinfecting agent;

FIG. 11 is a sectional view of a water supply fitting equipped with a chlorine venturi and removable core; and

FIG. 12 is a schematic, partly sectional view of the chlorine supply container of FIG. 1.

The embodiment of the present invention disclosed herein is attached to a vehicle and to a holding tank in the vehicle (neither being shown). This embodiment includes a carrier in the form of a rod **1** which extends through holes in brackets or side frames **3** of the vehicle chassis, and has an end portion **5** to serve as a handle to rotate the rod. Rod **1** is urged endwise by a spring **7** surrounding it and bearing against a washer **10** which is retained by cotter pin **11**.

Rod **1** (see FIGS. 3 and 4) is provided with a ring **13**, a J hook **14** and stub **15**. These parts may be attached to rod **1**, as by welding. Stub **15** seats in notch **15a** in the lower flange of the side frame **3** adjacent to spring **7**. The notch may be avoided by welding a lug on the lower flange of side frame **3** to be engaged by stub **15** when carrier **1** is rotated 90° from the position shown in FIG. 2. Elbow fitting **16** is rotatably mounted in ring **13**, is loosely supported in the ring by flange **16a** and is attached to one end of a tube **18** in which an inner tube **19** is freely slidable. As FIGS. 2, 6, 8 and 9 show, inner tube **19** is provided with a flange **20** and is cut away interiorly to receive a rotatable fitting **21** which is beveled at **22** to seat in the cut away portion of tube **19** and is exteriorly threaded as at **23**. Nipple **24** is connected to the outlet end of flexible hose or conduit **25** and is retained by collar **26**. That hose extends through tubes **19** and **18**, and elbow **16** and is attached to tank fitting **51**. The basin drain (not shown) is connected directly to fitting **51**. Part **25A** of the hose is for flexing when the carrier is in transit position (FIG. 2). Tube **18** forces up section of hose **25A** when in the transit position, thereby entrapping a limited amount of basin water in fitting **51** and the lower part of hose **25A**. When tube **19** is moved in tube **18** toward elbow **16**, hose **25** is compressed in tube **18**. Tubes **18** and **19** constitute a rigid shield for the hose.

A socket **30** (FIGS. 1, 6 and 9) is connected by hinge **32** to fitting **21**. Rod **35** fitted with handle **36** is at-

tached to socket 30. Spring clip 34 attached to socket 30 has latching engagement with tube flange 20 when the rod is positioned parallel to tubes 18 and 19, for example, when the vehicle is in transit. Spring clip 34 is formed to permit a limited amount of elevation of handle 37 before unlatching from flange 20. A clasp 38 attached to tube 18 (FIG. 6) serves to hold rod 19 in a latched position. By manipulating rod 35 the fitting 21 may be moved into position in a permanent sewer connection indicated at 39 in FIG. 1 where threads 23 may engage with any there present for a permanent connection. Rod 35 also serves to move the hose back into the tubes. End surface 31 of socket 30 is at an angle to the axis of rod 35 to facilitate handling of fitting 21.

FIGS. 10, 11 and 12 show the arrangement of parts to flood and wash out the corrugated hose with a chlorine enriched supply of rinse water. Fitting 51 is fastened to the dump valve and opens horizontally to connect to inlet portion 25A of hose 25. Fitting 51 is also connected to the basin drain. Water hose connector 40 is mounted at an inwardly facing angle to fitting 51 so that the water stream will be directed against the face of the dump valve to prevent any accumulation that may prevent proper closing. Water hose connector 40 is provided with a thread 40*a* at one end to connect with fitting 51 and suitable washer 42 and coupling 41 are positioned at the other end to connect with a water hose (not shown). Intermediate of the two ends, water hose connector 40 is provided with a reduced flow area and suitable venturi tube 44 fitted with core 45.

Tube 44 is connected by hose 46 to a chlorine supply in plastic bag 50 supported on a shelf (not shown). Bag 50 is fitted with an internal tube 48, weight 47 and stopper cap 49 so that the chlorine supply may be expelled from bag 50 by manually pressing on the bag or by allowing the venturi action of water hose connector 40 to draw the chlorine supply into the rinse water stream.

When the holding tank of the vehicle is to be emptied, the vehicle is parked adjacent to a sewer connection or dump station. Then, if frame 3 does not have a welded on lug to engage stub 15, rod 1 is pulled endwise to disengage stub 15 from the notch 15*a* in the flange of frame 3, thereby compressing spring 7. Rotation of rod 1 moves hook 14 downwardly thereby freeing tube 18 for removal therefrom. Tube 18 is lifted out of hook 14, rod 35 is disengaged from its clasp 38 and is moved high enough to disengage spring clip 34 from flange 20 of the inner tube 19. Then the nipple 24 is inserted in the sewer connection or dump station and the threads 23 of fitting 21 are engaged with a threaded member if one is present in the sewer connection.

From the above description the procedure to follow in making a tight and downward slopping connection to a sewer or dump station will be evident. Prior to disconnecting the apparatus it is desirable to flush and rinse hose 25 by connecting a water hose to water hose coupling 41. While manually holding portion 25A of the corrugated hose in an elevated position, the water supply is turned on to flush out fitting 51 and connected parts and to flood and fill that portion of the hose and fitting with a chlorine-enriched supply of water. Thereafter the hose is lowered and the surge of water through the remaining portion of hose 25 does an effective removal of all residue in the hose. If desired, this step may be repeated several times for thoroughly adequate cleaning action.

When the vehicle is to be moved, the apparatus may be "loaded for travel" by reversing the foregoing steps, i.e., by disconnecting fitting 21 from the sewer connection, urging the hose endwise in the tubes while moving the inner tube as far as possible in the outer tube, engaging rod 35 with clasp 38, placing tube 18 in hook 14 and rotating rod 1 and latching it in position by engaging stub 15 in its notch on the vehicle frame.

Having thus described this invention in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains to make and use the same, and having set forth the best mode contemplated of carrying out this invention, I state that the subject matter which I regard as being my invention is particularly pointed out and distinctly claimed in what is claimed, it being understood that equivalents or modifications of, or substitutions for, parts of the above specifically described embodiment of the invention may be made without departing from the scope of the invention as set forth in what is claimed.

What is claimed is:

1. Apparatus of the class described comprising in combination,
   a. a vehicle having a holding tank for liquid,
   b. a carrier rotatably carried by said vehicle,
   c. a rigid shield including telescoped tubes,
   d. a flexible, extensible conduit communicating at one end with the interior of said tank and extending through said shield, and
   e. a fitting connected to said shield and loosely carried by said carrier whereby the latter may be rotated to allow said shield and said conduit to be selectively positioned with respect to said vehicle while said conduit remains in communication with said tank.

2. The combination of elements set forth in claim 1 in which the conduit extends in the inner tube of the shield and to a point adjacent to the outer end of the inner tube.

3. The combination of elements set forth in claim 1 in which the shield is supported and held in position by the carrier when the vehicle is in transit.

4. The combination of elements set forth in claim 1 in which the conduit is extensible independently of said shield.

5. The combination of elements set forth in claim 1 in which said carrier is rotatable through approximately 90° to rotate the inlet of said fitting from a substantially horizontal position to substantially vertical position.

6. The combination of elements set forth in claim 1 in which the carrier is spring loaded and latched in position to hold the inlet of said fitting substantially horizontal during transit.

7. The combination of elements set forth in claim 6 in which a basin drain is connected to a tank fitting which is connected to the inlet end of said conduit and the portion of said conduit adjacent to the inlet end portion is maintained above the outlet of said tank fitting whereby drain water from said basin is trapped in said tank fitting.

8. The combination of elements set forth in claim 1 in which the outlet end portion of said conduit is positioned adjacent to a screw threaded fitting that is

rotatable with respect to said outlet end, and a movable handle is connected to said fitting to facilitate handling and positioning said fitting and attached conduit.

9. The combination of elements set forth in claim 8 in which said handle latches with said shield to maintain said conduit in said shield during transit.

10. The combination of elements set forth in claim 1 in which a water hose is connected to the conduit near its inlet end whereby a supply of water may be introduced into said conduit to flush out the conduit after the contents of the holding tank have been discharged.

11. The combination of elements set forth in claim 10 in which means is provided for introducing a cleansing agent into the flush water.

12. The combination of elements set forth in claim 11 in which the cleansing agent is carried in a manually collapsible container in direct communication with said hose connector.

* * * * *

United States Patent [19]

Gibbs, Sr.

[11] 3,730,228

[45] May 1, 1973

[54] HOSE-CASE ASSEMBLY

[76] Inventor: Paul H. Gibbs, Sr., 201 Wenda Way, El Paso, Tex. 79915

[22] Filed: Jan. 5, 1972

[21] Appl. No.: 215,463

[52] U.S. Cl. 138/106, 4/1, 4/114, 248/49, 285/61, 285/302

[51] Int. Cl. F16l 7/00, F16l 9/22, F16l 57/00

[58] Field of Search ....138/106, 107, 103, 138/110, 111, 114, 118, 120, 148; 285/45, 61, 226, 302; 248/49, 84, 86, 87; 4/1, 95, 114, 197, 252 R, 268, 276

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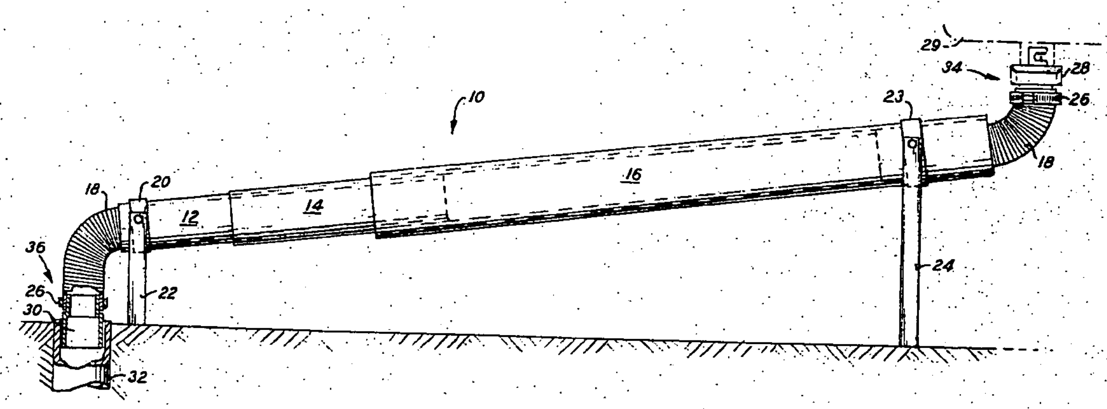
Primary Examiner—William I. Price
Assistant Examiner—Stuart S. Levy
Attorney—David Paul Weaver et al.

[57] ABSTRACT

A hose case for supporting and enveloping a flexible hose that is capable of longitudinal extension and contraction in any position of extension and contraction of the hose. The case is formed of a plurality of telescoping tubular sections, through which the hose extends, that can be relatively extended and contracted in correlation with the extension and contraction of the hose.

6 Claims, 3 Drawing Figures



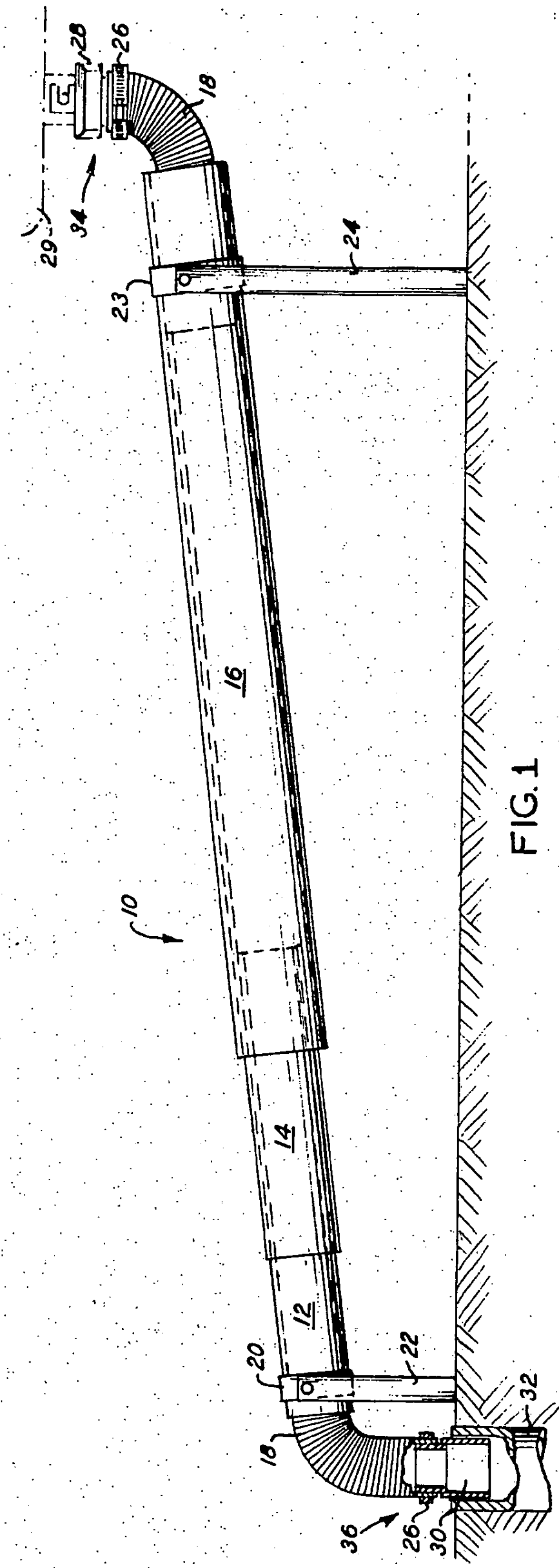


FIG. 1

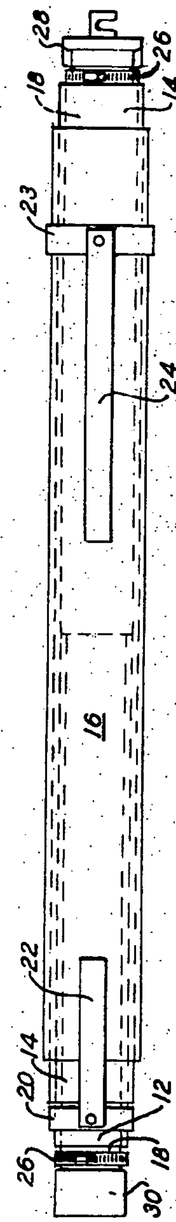
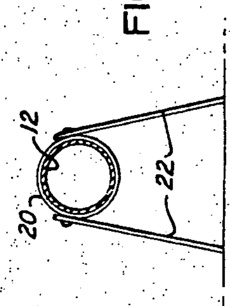


FIG. 2

FIG. 3



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ATTORNEYS

HOSE-CASE ASSEMBLY

BACKGROUND OF THE INVENTION

In connecting the outlet tank of a trailer to a sewer in a trailer park in order to convey sewage from the tank to the sewer, it is common practice to connect the tank to the sewer by a flexible hose, capable of extension and contraction, so that the sewage may gravitate from the tank to the sewer. It is desirable that the hose be supported in such a manner as to enable the sewage to gravitate from the outlet tank to the sewer without sags in the hose in which sewage may accumulate and freeze, and in such a manner that the hose is protected against damage. It is also desirable that the hose be supported in such a manner that it can be handled in a sanitary manner without the sewage coming in contact with the user and that the support and the hose, as a unit, can be easily stored in a relatively small space when the hose is not in use.

While supports for flexible hose of the type described above have been disclosed, such as the supports shown in U.S. Pat. Nos. 3,169,741; 3,406,933; 3,493,204; and 3,572,622, they have not succeeded in providing a support that fulfills all of the requirements set forth above.

SUMMARY OF THE INVENTION

This invention achieves the desired objectives set forth above by including a hose case formed of telescoping tubular sections through which the hose extends, that enable the hose case to be extended and contracted in correlation with the extension and contraction of the hose. The opposite ends of the hose extend through the opposite free ends of the case so that they may be attached to the tank outlet and the sewer while the remainder of the hose is enveloped by the case.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a view of an assembly of the hose and the hose case in extended positions with the hose ends attached to the tank outlet and the sewer;

FIG. 2 is a view of the hose-case assembly in the contracted position it assumes when it is being stored; and

FIG. 3 is a view of a support mounted to the case that is used to support the case above the ground.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The hose case 10 comprises three telescoping tubular sections 12, 14, and 16 that envelop a flexible sewage hose 18 that extends completely through the hose case 10. The hose 18 is a conventional item that is so constructed that it extends and contracts to conform to the length of the hose case between the maximum length of the hose case and the minimum length of the hose case.

A ring 20 (see FIG. 3) extends about the periphery of the section 12 and is mounted to slide along the section 12. The ring 20 has a pair of relatively short legs 22 pivoted thereto on opposite sides thereof. A ring 23, constructed similarly to the ring 20, extends about the periphery of the section 16 and is mounted to slide along the section 16. A pair of relatively long legs 24 are pivoted to the ring 23 similarly to the manner in which the legs 22 are pivoted to the ring 20. The legs 22

and 24 may be swung between the FIGS. 1 and 3 position wherein they extend downwardly of the case 10 and the FIG. 2 position wherein they extend longitudinally of and alongside the case 10.

The ends of the hose 18 project a short distance beyond the ends of the sections 12 and 16. An O-shaped clamp 26 clamps the end of the hose 18 that projects beyond the free end of the section 16 to a fitting 28 that is adapted to connect the hose to the holding tank outlet of a trailer 29 (FIG. 1). Another O-shaped clamp 26 clamps the end of the hose 18 that projects beyond the free end of the section 12 to a fitting 30 that is adapted to connect the hose to a sewer 32. The fitting 28 and the clamp 26 associated therewith constitute a fitting assembly 34 and the fitting 30 and the clamp 26 associated therewith constitute a fitting assembly 36. The fitting assemblies 34 and 36 cannot respectively move into the tube sections 16 and 12 due to the largest diameters of the fitting assemblies being greater than the diameters of the openings of the free ends of the tubular sections of the case 10 with which they are associated.

When the hose-case assembly is not in use, the case 10 is in the collapsed position shown in FIG. 2 with the sections 12, 14, and 16 in contracted position. In this position, the fitting assemblies 34 and 36 respectively bear against the free ends of the sections 12 and 16, as permitted by the flexible construction of the hose 18. In addition, in this position, the legs 22 and 24 are swung so as to extend axially of the hose-case assembly along the periphery of the case 10. While in this position, the hose-case assembly is usually stored in a storage compartment in the trailer 29.

When the trailer is in a trailer park or camping ground having sewage facilities that include a sewer 32, the hose-case assembly is taken out of the storage compartment, and the fitting assembly 36 is extended away from the tubular section 12 and is inserted into the sewer 32. The hose case is then extended an amount sufficient to bring the fitting assembly 34 close to the holding tank outlet in the trailer 29 and the fitting assembly 34 is extended away from the tubular section 16 and is attached to the holding tank outlet. The legs 22 and 24 are now swung downwardly to the ground-engaging FIG. 1 position so that they may act as support means to support the hose-case assembly in the inclined position of FIG. 1 wherein the hose-case assembly is inclined downwardly from the trailer 29 to the sewer 32 so that sewage may gravitate from the holding tank of the trailer 29 into the sewer 32. Because the fitting assembly 34 has a larger diameter than the diameter of the opening in the free end of the tubular section 16, the extension of the hose case, which includes the movement of the section 16 away from the sections 12 and 14, will automatically extend the hose 18 with the fitting assembly 34 bearing against the free end of the tubular section 16. The inclination of the hose, to fit the contour of the ground, is adjusted by sliding the rings 20 and 23 lengthwise of the hose case 10. In addition, the inclination can be adjusted by varying the extent to which the legs 22, 24 are swung downwardly from the FIG. 2 position.

The above described installation of the hose-case assembly has the following advantages:

a. The adjustability of the legs **22, 24** on the hose case **10** allows for proper drainage flow through the hose **18** regardless of the length of the hose-case assembly within the maximum and minimum lengths of the hose-case assembly.

b. Since the case **10** envelops the hose **18** for its entire length, except for the ends of the hose, in all lengths to which the hose-case assembly is adjusted, the hose is protected by the case from damage that may occur from stray objects, such as stones or other flying objects, or from people tripping over the hose.

c. Since the portion of the hose **18** within the case **10** is confined by the case to incline linearly, there are no sags in the hose which can collect liquid sewage and freeze and thus damage the hose and create undesired pockets of sewage.

When the need for using the hose-case assembly ends and it is desired to dismantle this assembly, the fitting assembly **34** is detached from the holding tank outlet of the trailer **29**; the detached end of the hose-case assembly is elevated; the hose-case assembly is flushed with water from a hose entering its detached end so that the water may clean out any residual sewage in the hose **18** and flush it into the sewer **32**; the fitting assembly **36** is detached from the sewer **32**; the hose-case assembly and the legs **22, 24** are contracted into the FIG. **2** position; and the hose-case assembly is stored in the storage compartment of the trailer **29**. This arrangement enables the hose-case assembly to be dismantled and stored in a sanitary manner without the hands of the user coming into contact with any sewage that is in the hose **18** and enables the hose-case assembly to be contracted for easy storage in the trailer **29**.

I claim:

1. In combination with a flexible hose so constructed as to be capable of longitudinal extension and contraction, said hose having a first end portion that is adapted to be attached to a holding tank outlet and a second end portion that is adapted to be attached to a sewer in such a manner as to incline downwardly from the tank outlet to the sewer, a hose case comprising: a plurality of telescoping tubular sections having openings extending therethrough through which the hose extends so that the sections envelop the hose, said sections being so constructed as to be capable of relative longitudinal extension and contraction in correlation with the extension and contracting of the hose, said sections including a first section having a first free end located proximate to said first hose end portion and a second section having a second free end located proximate to said second hose end portion, whereby the hose case supports the portion of the hose that is between said section ends, leaving unsupported only said end portions of the hose, regardless of the length to which the hose has been extended or contracted.

2. The hose-case combination of claim **1** further comprising: a first, relatively long, support means mounted to and extending downwardly of said first section; and a second, relatively short, support means mounted to and extending downwardly of said second section, said first and second support means being adapted to engage the ground and support the case so that it inclines downward from said tank outlet to said sewer.

3. The hose-case combination of claim **2** wherein each of said support means comprises: leg means mounted to its associated section for movement between a position wherein it extends alongside its associated section and a position wherein it extends downwardly of its associated section.

4. The hose-case combination of claim **3** further comprising: means mounting each of said leg means for adjustment longitudinally of its associated section.

5. The hose-case combination of claim **2** wherein said first support means comprises: a first ring mounted to said first section for adjustment longitudinally of said first section; and a pair of relatively long legs pivoted to said first ring on opposite sides of said first section for movement between a position wherein they extend alongside said first section and a position wherein they extend downwardly of said first section; and wherein said second support means comprises: a second ring mounted to said second section for adjustment longitudinally of said second section; and a pair of relatively short legs pivoted to said second ring on opposite sides of said second section for movement between a position wherein they extend alongside said second section and a position wherein they extend downwardly of said second section.

6. The hose-case combination of claim **1** further comprising: a first fitting assembly, mounted to said first hose end portion outwardly of said first free end, adapted to be attached to said holding tank outlet, the largest diameter of said first fitting assembly being greater than the diameter of the opening at said first free end; and a second fitting assembly, mounted to said second hose end portion outwardly of said second free end, adapted to be attached to said sewer, the largest diameter of said second fitting assembly being greater than the diameter of the opening at said second free end; whereby an extension of said case causes a corresponding extension of said hose.

* * * * *

United States Patent [19]

Feliz

[11] **3,811,462**

[45] **May 21, 1974**

[54] **RECREATIONAL VEHICLE UTILITY STOWAGE AND TRANSFER SYSTEM**

[76] Inventor: **Jack M. Feliz,** 34-808 Via Echo, Palm Springs, Calif. 92262

[22] Filed: **June 8, 1972**

[21] Appl. No.: **260,997**

[52] **U.S. Cl.** **137/344,** 137/355.16, 137/579, 285/165, 285/274

[51] **Int. Cl.** **F16k 27/12**

[58] **Field of Search** 137/355.16, 355.17, 344, 137/615; 285/7, 165, 273, 274

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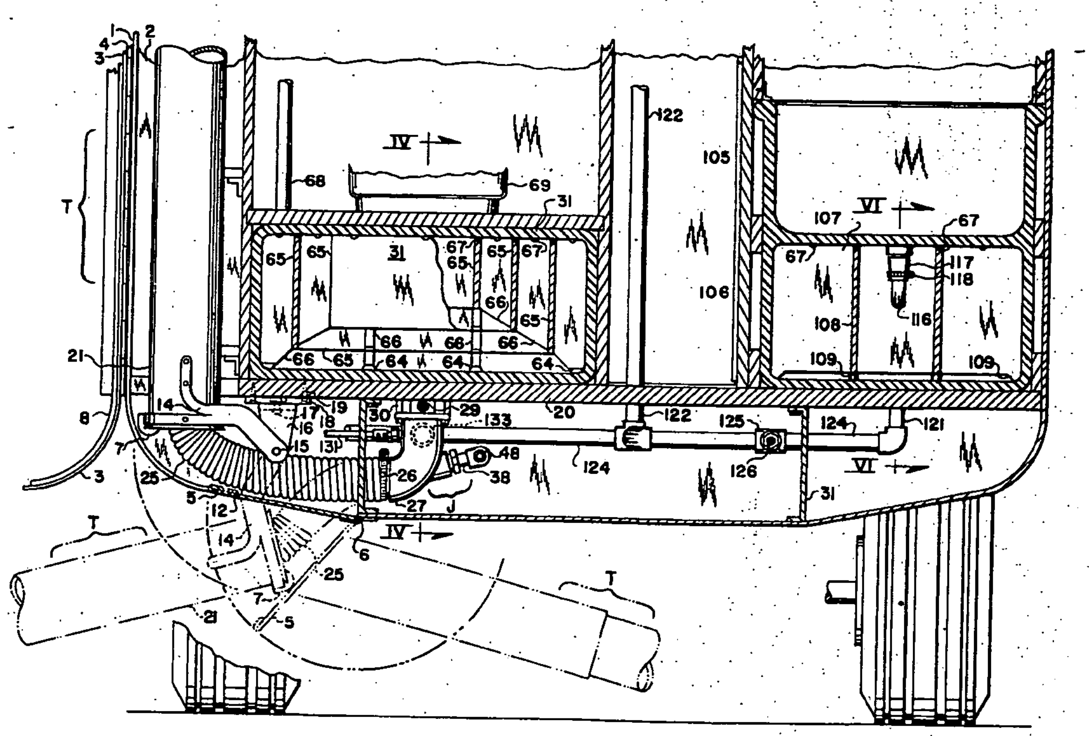
Primary Examiner—Henry T. Klinksiek

Attorney, Agent, or Firm—Harris, Kern, Wallen & Tinsley

[57] **ABSTRACT**

An improved utility transfer and stowage system for recreational vehicles and other passenger vehicles or the like, comprising a baffled toilet holding tank and respective permanently installed, self-supporting, telescopic drain line assembly, in which the latter is provided with the inherent flexibility to enable its transfer from a stowage to a drain position. The distal end of the above drain line is provided with a water tight plug-in coupling, for connecting to the park sewer receptor, and its upstream end is provided with a permanently installed water wash down jet; a bathtub and integral baffled holding tank, of which the latter is cross connected with the kitchen sink and lavatory drains through suitable piping and valves, thereby providing for the sanitary isolation and controlled diversion of the accumulated drains into either a catch bucket or into the above mentioned toilet holding tank drain line assembly as deemed appropriate; a baffled potable water holding tank and respective permanently installed, precoiled, self-supporting, potable water hose, in which the distal end of the latter is provided with a plug-in adapter coupling, for connecting to the park potable water valve; a precoiled self-supporting electrical entrance cable and a pair of hinged covered carrying tubes for retention of the above mentioned cable and water hose.

4 Claims, 13 Drawing Figures



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SHEET 1 OF 4

FIG. 1.

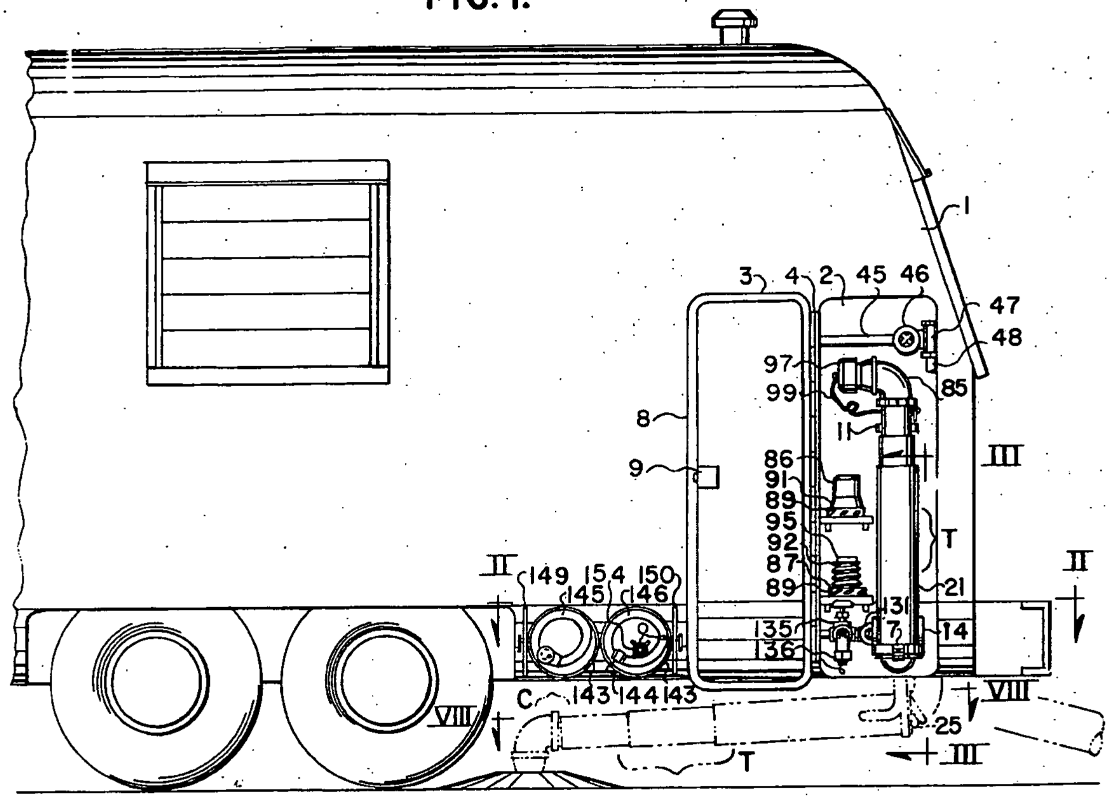


FIG. 8.

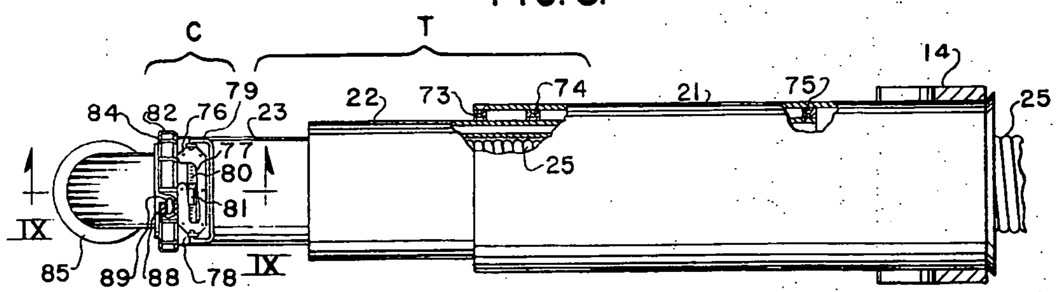


FIG. 9.

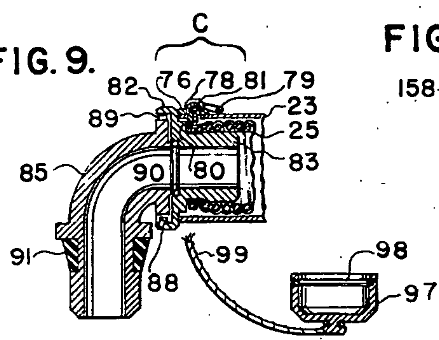


FIG. 10.

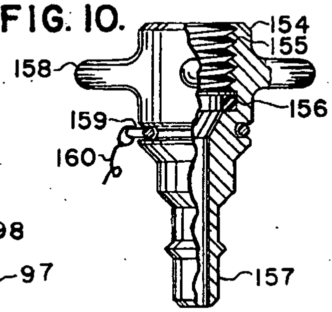
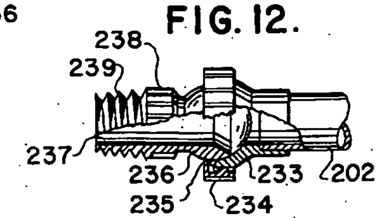


FIG. 12.



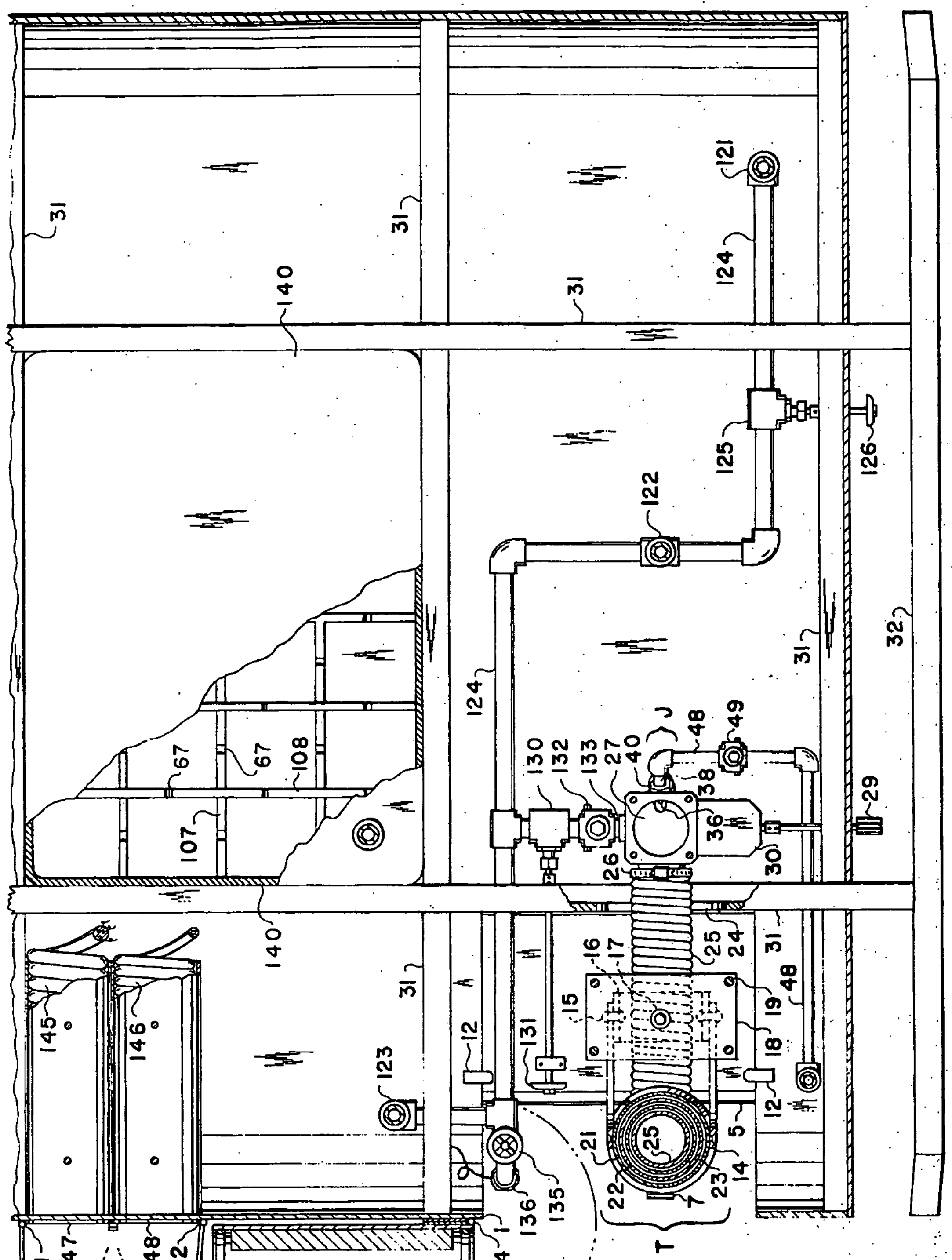


FIG. 2.

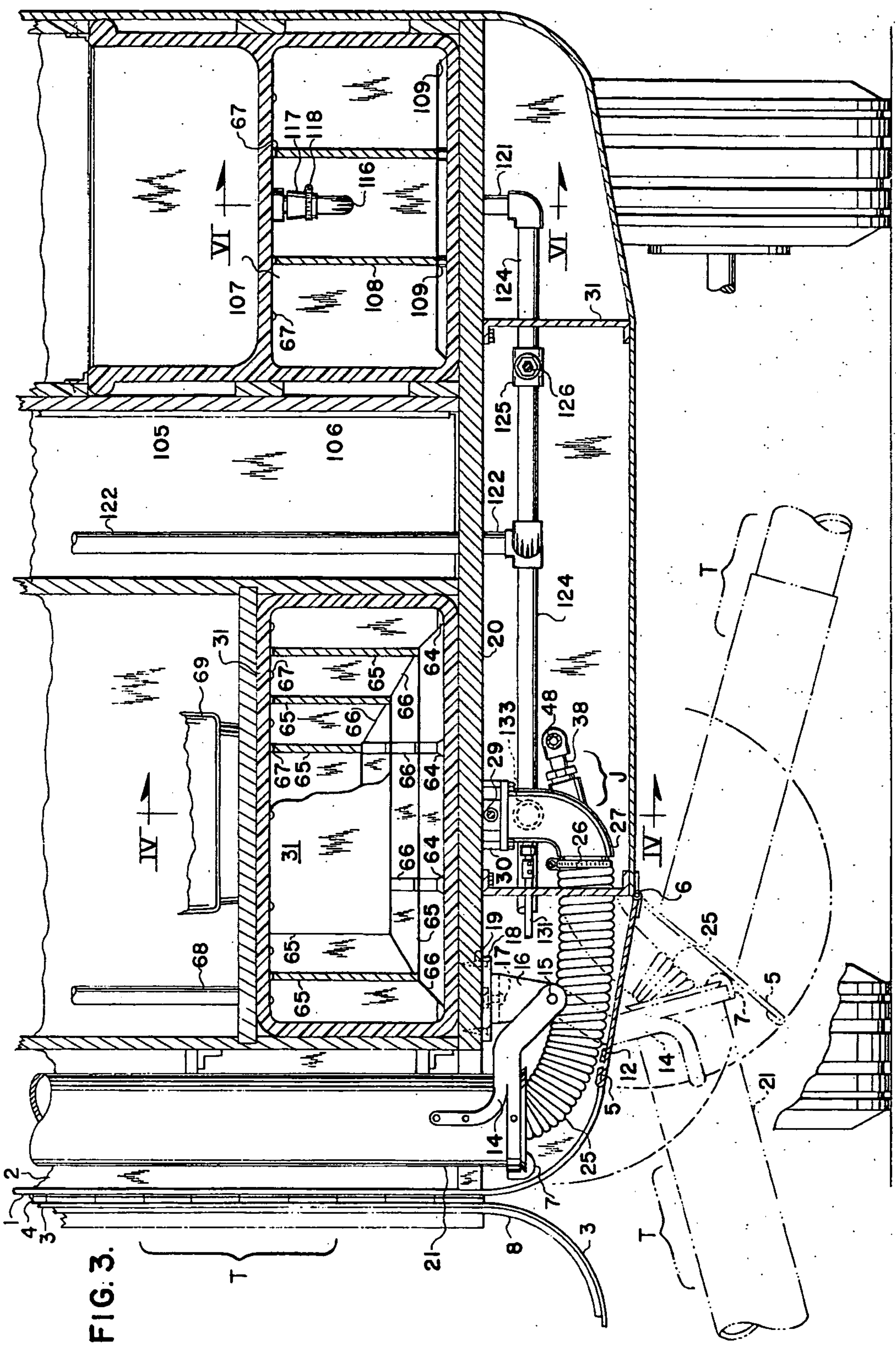


FIG. 3.

FIG. 4.

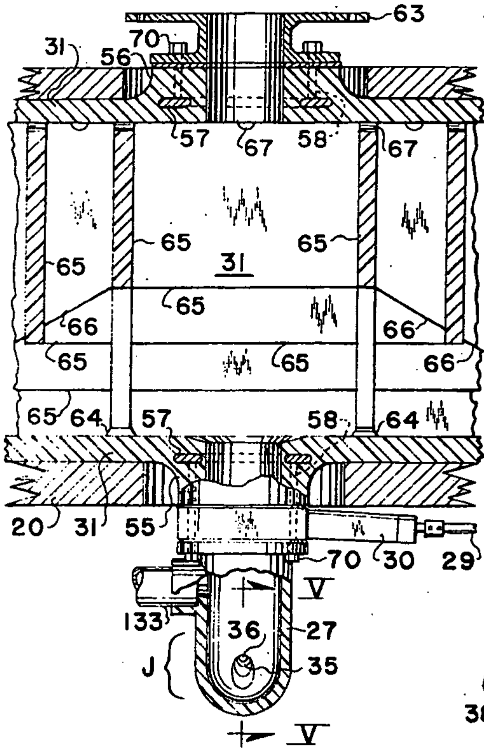


FIG. 6.

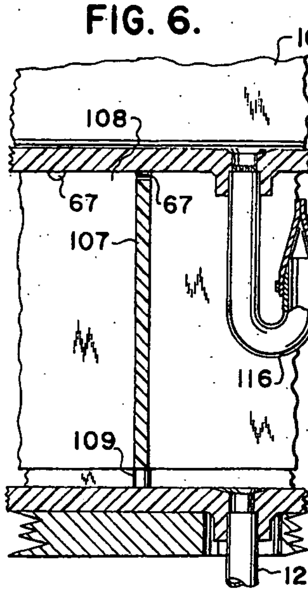


FIG. 7.

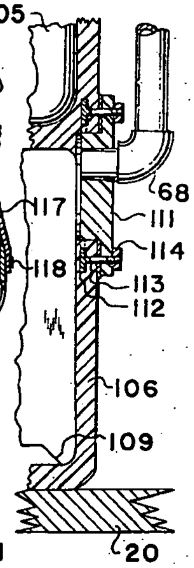


FIG. 13.

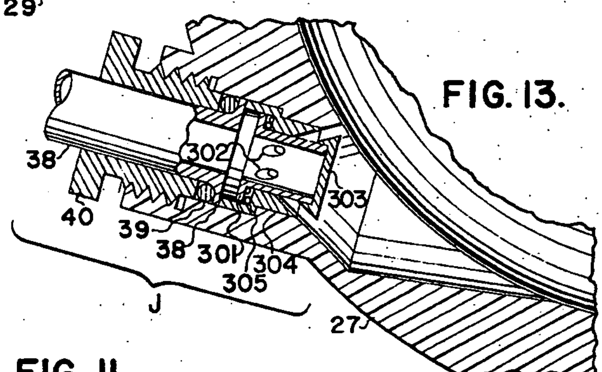


FIG. 5.

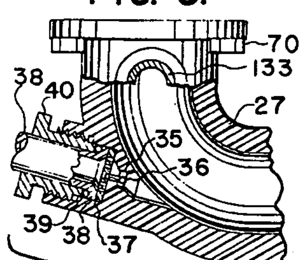
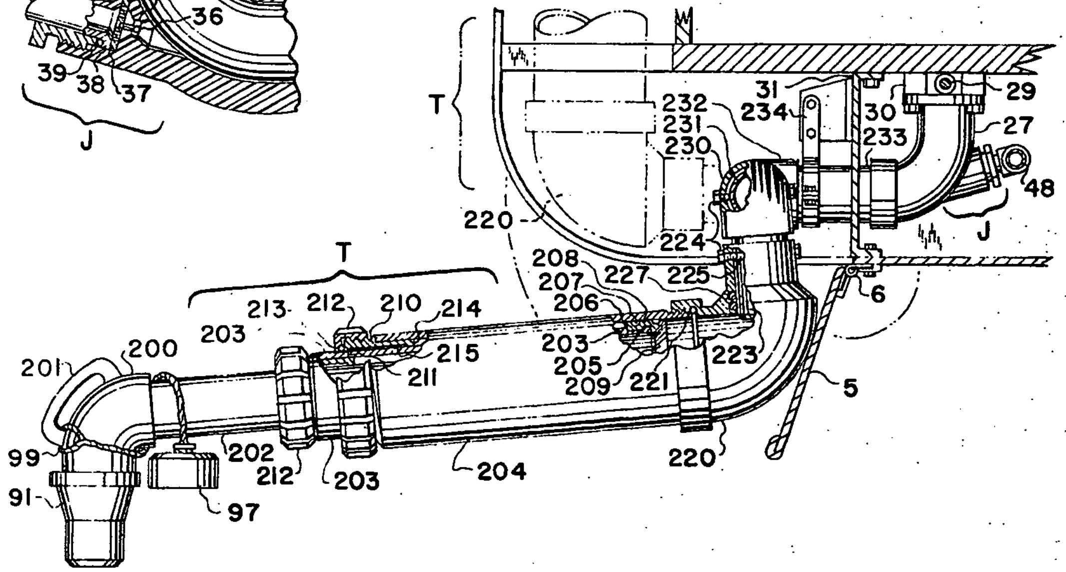


FIG. 11



RECREATIONAL VEHICLE UTILITY STOWAGE AND TRANSFER SYSTEM

PRIORITY CLAIM

I hereby claim the priority provided by my Disclosure Document No. 002350, filed June 17, 1970.

BACKGROUND OF INVENTION

This invention relates to an improvement of the utility system for recreational vehicles, passenger buses or the like.

The chief aim of the present invention is to provide for a more manageable, sanitary and safer utility stowage and transfer system.

SUMMARY AND OBJECTS OF INVENTION

A general object of the present invention is to provide an improved toilet holding tank and respective drain line; a sink and bathtub holding tank and respective drain lines; a potable water holding tank and respective self-supporting hose; a self-supporting electric entrance cable; and a pair of carrying tubes for the above mentioned cable and hose.

In known types of flexible toilet holding tank drain lines, they are, in the main, not entirely satisfactory due to their inherent encumbrance in connecting, disconnecting, draining, washing, handling and stowing. It is not uncommon to be confronted with the horrendous task of cleaning up the parking site after an accidental spillage caused by the retraction of the drain hose from non-secure connections at the holding tank or at the park sewer receptor when dumping the contents of the holding tank or when lifting the hose to drain out low pockets prior to disconnecting for travel, and further to encounter, the unsanitary and revolting job of disconnecting from the toilet holding tank, washing out and ultimately stowing the wet limp sewer drain hose into its remote carrying tube for travel, invariably resulting in contamination of yourself and your potable water hose.

It is an object of the present invention to eliminate the above mentioned filthy and degrading job, by providing a permanently installed toilet holding tank sewer drain line, supported within a hinged and swiveled series of telescopic tubes, to insure proper gravitational draining, combined with adequate flexibility to facilitate handling and stowage, and further, by providing for a water wash down jet permanently installed within the above mentioned toilet holding tank drain line.

It is another object of the present invention to eliminate the need for carrying an extra length of flexible sewer drain hose to reach the occasional distant park sewer receptor, and to reduce the number of hose fittings required to make connections to the varied park sewer receptors, and further to reduce the discomforting, time consuming job of exchanging the conventional type couplings. In the present invention, connecting and disconnecting to the varied park sewer receptors are facilitated by the use of a combination internal-external quick change coupling mounted to the distal end of the telescopic tubes. The internal portion of the quick change coupling readily permits interchange of the varied type sewer couplings. The external portion of the quick change coupling facilitates disengagement from the distal end of the telescopic tubes, thereby permitting withdrawal of the quick change

coupling and the attached flexible drain hose to reach the occasional distant park sewer receptor, located beyond the normal extended range of the telescopic tubes. The above extended range also provides the flexibility required to connect with the occasional park sewer receptor, whose direct access is obstructed and further, to provide the necessary flexiblity to connect with a sewer receptor located in the bottom of an antifreeze box.

When the recreational vehicle park sewer receptors become nationally standardized a more self-contained modification of the above mentioned toilet holding tank drain line is provided for in this invention. In its present form the above modification can be plugged into all of the standard vertical sewer receptors. During the transition to standardization, certain interim modifications of the sewer couplings are also provided for in this invention.

The above mentioned toilet holding tank drain line assembly and the principal modification thereto, will transform a degrading, time consuming job into a relatively clean task as easy to plug in and out as the electrical entrance plug. The above mentioned telescopic drain line assemblies could be feasibly used on liquid carrying vehicles, transporting gasoline, milk and the like.

A further object of this invention is to reduce pollution of our recreational areas caused by the uncontrolled draining on our camp sites of seemingly harmless lavatory, kitchen sink and bathtub drains which are frequently contaminated with human refuse, introduced directly into the drain system or indirectly contaminated from residue deposited in the open cross-connected drain lines from previous occasions when dumping the toilet holding tank. The above unsanitary conditions are averted in the present invention by the installation of an independent lavatory, sink and bathtub drain holding tank, connected by suitable piping and valves to maintain a sanitary isolated storage and to control the diversion of the respective drain waters into either, a catch bucket for ultimate carrying to a designated disposal station, in parks where hook ups are not available or by diverting the drains through a stop and check valve into the toilet holding tank drain line where park hook ups are provided.

It is another object of the present invention to dispense with the need for washing, coiling, and tying the electric entrance cable and the potable water hose prior to stowing for travel. Washing the above disconnected cable and hose is necessary because the utility area is frequently wet and contaminated with human refuse. In the present invention the above undesirable task is eliminated by preforming a resilient electric cable and potable water hose into resilient helical coils having built-in memories biasing them into contracted states, or by encasing them in or building thereinto suitable plastic coated coil springs having sufficient tension to provide self-support above the ground level between the park utility receptors and the recreational vehicle. When released from the park utility receptors the above mentioned cable and hose will readily recoil into their respective carrying tubes for travel, and further, the distal end of the above mentioned water hose is provided with an adapter coupling, making the connection to the park water valve as easy to plug in and out as the above mentioned electrical entrance plug.

More generally, an object is to provide a tubular housing containing a spring biased helical conduit which will retract itself into its housing after being withdrawn therefrom and released.

A further object of this invention is to diminish the dangerous and damaging forces created by the free surface effect of a fluid in motion. This condition is very prevalent in partially filled potable water, toilet, and bathtub holding tanks where suitable baffle plates are non-existent, thus contributing to the upsetting moments of force as the recreation vehicle turns a corner, sways due to wind action, or uneven road surfaces. In addition, acceleration and deceleration of the vehicle creates similar forces which contribute to escalated wear of the vehicles power train and brakes, thereby causing premature repairs. In the present invention these safety hazards and undue wear are greatly reduced by the installation of longitudinal and transverse divisional baffles within the holding tanks.

Another object of this invention is to eliminate the extraneous fittings and rust frozen retainer nuts and studs on the inlet and outlet flanges to the toilet holding tank. In the present invention nonferrous retainer rings with integral studs are embedded in the tank flanges thereby permitting the toilet and the holding tank drain valve to be connected directly to the tank surfaces, thus contributing to compactness and easy removal of the retaining nuts when effecting repairs.

It is another object of the present invention to conserve space and cost by fabricating the bathtub and its associated holding tank into an integral unit.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be evident to those skilled in the art to which the invention relates in the light of this disclosure, may be achieved with the exemplary embodiments of the invention illustrated in the accompanying drawings and described in detail hereinafter.

DESCRIPTION OF DRAWINGS

In the drawings:

FIG. 1 is a fragmentary side elevational view, of one form of a recreational vehicle, illustrating the improved electric, potable water, and toilet holding tank, transfer and travel stowage facilities;

FIG. 2 is an enlarged fragmentary plan view, partly in section, taken as indicated along the angled arrows II—II of FIG. 1, illustrating a portion of the improved toilet holding tank drain assembly, sink and bathtub drain assembly, potable water holding tank, electric cable, and potable water hose assemblies;

FIG. 3 is an enlarged fragmentary view, partly in section, taken as indicated along the angled arrows III—III of FIG. 1, illustrating an improved toilet holding tank with the respective drain assembly, and the combination bathtub with the respective drain holding tank;

FIG. 4 is an enlarged fragmentary view, partly in section, taken as indicated along the angled arrows IV—IV of FIG. 3, illustrating the toilet holding tank baffle plates, embedded bolt rings and a portion of the water wash down jet;

FIG. 5 is an enlarged fragmentary view, partly in section, taken as indicated along the angled arrows V—V of FIG. 4, illustrating details of the water wash down jet;

FIG. 6 is an enlarged fragmentary view, partly in section, taken as indicated along the angled arrows VI—VI of FIG. 3, illustrating the bathtub holding tank baffle plates, drain trap and non-return valve;

FIG. 7 taken with FIG. 6, constitutes an end portion of the bathtub holding tank, illustrating the tank vent and access cover;

FIG. 8 is an enlarged fragmentary plan view, partly in section, taken as indicated along the angled arrows VIII—VIII of FIG. 1, illustrating the toilet holding tank drain hose, supporting telescopic tubes and the dual quick change coupling;

FIG. 9 is a fragmentary view in section, taken as indicated along the angled arrows IX—IX of FIG. 8, illustrating details of the dual quick change coupling and associated attachments;

FIG. 10 is a side elevational view, partly in section, illustrating the adapter coupling for the distal end of the potable water hose;

FIG. 11 is a fragmentary view, partly in section, corresponding to FIG. 3, illustrating a modification to the toilet holding tank drain assembly;

FIG. 12 is a fragmentary view, partly in section, corresponding to a portion of FIG. 11, illustrating a modification to the terminal elbow of the telescopic tube assembly; and

FIG. 13 is an enlarged fragmentary view, in section, corresponding to FIG. 5, illustrating a modification to the water wash down jet.

DESCRIPTION OF EXEMPLARY EMBODIMENTS OF THE INVENTION

Referring to FIG. 1 of the drawings, the vehicle 1 is provided with a built-in locker 2, whose access door 3 is mounted flush and hinged at 4 to the exterior hull plating. The door 3 is provided with a resilient gasket 8 and a locking device 9. The contents of the locker 2 will be described hereinafter.

Toilet Holding Tank Drain Assembly

Housed within the previously mentioned locker 2 is the telescopic toilet holding tank drain hose 25, supported within the hinged and swiveled telescopic tube assembly T, and associated quick change couplings, to be described later. When the door 3 is in the open position the telescopic tubes T may be withdrawn from the spring retaining clips 11 and lowered from a stowage to a draining position on the affixed offset hinges 14, rotating downwardly about fulcra 15 (FIGS. 2 and 3), in turn supported by the rotatable swivel bracket 16, in turn secured to the swivel fulcra 17, which in turn is secured to the swivel plate 18 and the latter in turn is secured as by screws 19 to the lower surface of the vehicles floor boards 20. The trap door 5 is normally closed by the spring-biased hinge 6. The door 5 is mechanically urged into the open position as the telescopic tubes T are lowered, at first being urged by hose 25 and subsequently by the plastic lug 7, which is secured to the hinge 14 and the telescopic tube 21. The above arrangement facilitates handling, stowing and draining of the hose 25, by providing stowage for the telescopic tubes T, and the drain hose 25 without disconnecting from the vehicle 1, and further, to be wholly contained within the exterior hull plating for road travel or readily lowered into a draining position below the overhang of vehicle 1, thereby permitting horizontal rotation of the telescopic tube assembly T within a scope of 360° for

alignment with the varied park sewer receptors, and further providing a supported incline that will assure proper gravitational draining of the drain hose 25. Retracting and stowing of the telescopic tubes T, for road travel, automatically permit the trap door 5 to close against suitable stops 12, thence when door 3 is manually closed it will in turn overlap the door 5, and form an interlocking cover over the bottom of the locker 2, thus restoring the streamline characteristics to the exterior hull plating of the vehicle 1. The upstream end of the drain hose 25 is permanently secured by clamp 26 to the elbow 27 insuring a secure connection between the flexible hose 25 and the stationary elbow 27, however, the clamp 26 is readily removed to effect repairs to the toilet drain system. A lightening hole 24 in the vehicle frame 31 (FIG. 2) is utilized to effect passage of the hose 25.

Jet Assembly

Referring to the FIGS. 2, 3, 4 and 5, the water wash down jet assembly J is integral with elbow 27, comprising a jet orifice 35, and a centrally positioned diffuser ball 36, (as best seen in FIG. 5) which the latter in turn is secured to the removable strainer plate 37, which in turn is retained by the flanged nipple 38, the latter in turn is made water tight by the neoprene O-ring 39 and the threaded throat bushing 40. The water for the jet assembly J is supplied from the vehicles potable water piping system 45, (FIG. 1) through the cut out valve 46 located in locker 2. The potable water system is safeguarded from contamination by the anti-siphon valve 47, and the swing check valve 49 (FIG. 2) which are installed in the wash water pipe line 48 between the potable water cut out valve 46 and the water wash down jet assembly J. The activation of the jet assembly J is controlled by cut out valve 46 and should be preferably opened prior to dumping the contents of the toilet holding tank 31, by means of the reach rod 29 and cut out valve 30, thereby intensifying the flow of its contents and preventing a back surge into the jet assembly. After the contents of the tank 31 have been evacuated, the holding tank valve 30 should be closed, then subsequently the closing of the valve 46 will insure a clean and adequately drained hose 25, and in addition insure a fully charged potable water system prior to disconnecting from the park utilities.

The above arrangement of the toilet holding tank drain assembly and respective water wash down jet, precludes the need for disconnecting, handling, hand washing, and stowing a wet limp hose in its remote carrying tube after each use as currently practiced.

Toilet Holding Tank Assembly

Referring now to FIGS. 3 and 4, the toilet holding tank 31 is rectangular in plan and is constructed of fiber glass or other suitable material. Integral with tank 31, is the reinforced lower outlet flange 55 and the upper reinforced inlet flange 56. Embedded within the above mentioned flanges are stainless steel or other suitable nonferrous type retaining rings 57, and integral studs 58, threaded on the distal ends, which facilitate securing of the dump valve 30 and the toilet 69 directly to the tank 31, which will eliminate extraneous fittings, provide compactness and facilitate removal of the stainless steel nuts 70 to effect repairs. There are certain type toilets that can be attached directly to the upper flange 56, however an adapter spool 63 is provided (FIG. 4) to accommodate those toilets with different base configurations. The tank 31 is further provided with a baffle plate assembly which comprises the vertical transverse and longitudinal baffle plates 65, which relate to a series of rectangular boxes diminishing in size which are open at the top and bottom and held an equal distance apart by webs 66. The inner bottom of tank 31 supports the feet 64 of the webs 66. The webs 66 in turn are secured to and support the baffle plates 65 which in turn support the top of tank 31, the latter in turn supports the integral toilet mounting flange 56 and in turn supports the toilet 69 (FIG. 3) secured thereto. The lower core of the baffle plates 65 and webs 66 are pyramidal in configuration to permit dispersal of the larger solid wastes as the liquid level rises in the tank 31, thus preventing the total accumulation of waste being trapped in the central cell directly under the toilet discharge. The tops of the baffle plates 65 and the webs 66 are provided with grooves 67 to permit air equalization. The vent pipe 68 provides for gas escape and pressure equalization of tank 31. The configuration of the baffle plates 65 and the webs 66, facilitates draining of the solid wastes and reduces the upsetting moments of force created by the free surface effect of a fluid in motion.

Telescopic Tube Assembly

Referring now to FIGS. 1, 8 and 9, the telescopic tube assembly T comprises a series of tubes increasing in diameter to provide sufficient clearance between sections to receive the low friction stationary guide rings 73, the stationary stop rings 74 and the slidable guide rings 75. The rings 73 and 74 are secured to the inside of the tube 21 and the ring 75 is secured to the outside of tube 22. As the tube 22 is extended, the ring 75 is slidingly engaged with the tube 21 until terminated by striking against the stop ring 74. The overlapping distance, between rings 73 and 75 provide for the mutual support of their respective tubes. In the interest of brevity, identical stop and guide rings mentioned above are located between the tubes 22 and 23 but are not illustrated. Total retraction of the telescopic tubes 22 and 23 are prevented by the lug 7 and the handle 79 respectively.

A cylindrical cam plate 76 is secured to the distal end of the tube 23, and is provided with a helical groove 77 to receive the hose clamp housing 81, as will be described later. Integral with the cam plate 76 are the hinge brackets 78, provided to support the telescopic tube handle 79.

Quick Change Coupling Assembly

Referring now to FIGS. 8 and 9, the dual quick change coupling assembly C, comprises the coupling 82 of which the upstream portion 83 receives the distal end of the flexible drain hose 25, secured thereon by means of the hose clamp 80. The hose clamp worm gear housing 81 is inserted in the helical groove 77 of the cam plate 76 and is rotatably engaged by gripping the hand grip grooves 84 and the handle 79, to effect a semi-rigid connection between the coupling 82 and the telescopic tube 23. The semi-rigid connection permits limited flexibility to properly align the interchangeable couplings with the park sewer receptors to be described later. The dual quick change coupling assembly serves a two-fold function in that it provides an expeditious means to disengage the coupling 82 from

the telescopic tube 23, for the purpose of withdrawing the drain hose 25, in order to reach the occasional distant park sewer receptor located beyond the normal extended range of the telescopic tubes, or when additional flexiblity is required to connect to the occasional obstructed, or to the deep set sewer receptor located in the bottom of an antifreeze box. The above mentioned extended range is achieved by the utilization of a close-wound tension type sewer drain hose, in which the extended length is equivalent to two lengths of the more common open-wound compression type sewer hose. The self-recoiling feature of the close-wound drain hose readily permits retraction into the telescopic tubes when released from the sewer receptor.

The other function of the dual quick change coupling 82 is to provide a means for receiving the interchangeable couplings 85, 86 and 87 and further to provide a water tight coupling seal. As seen in FIGS. 8 and 9 the coupling 85 is engaged to the dual coupling 82, and the straight couplings 86 and 87 are stowed in locker 2 of FIG. 1. The coupling 82 is further provided with the internal segmented threads 88 and the O-ring 90. The interchangeable couplings 85, 86 and 87 are provided with external segmented threads 89 and when rotatably engaged against the threads 88, a water tight seal will be effected between the coupling 82, the O-ring 90 and the above mentioned interchangeable couplings 85, 86 and 87.

The couplings 85 and 86 are constructed of ABS plastic or other suitable material, and secured thereon, are the tapered neoprene stopper rings 91 or other suitable resilient material, and when forced into the park sewer receptors, a substantial degree of water tight integrity is created. The coupling 87 is constructed of brass or other non-ferrous metals, in order to resist damage to the standard tapered pipe threads 92. The coupling 87 will provide a water tight seal when engaged with like standard threads of the park sewer receptors; however, in view of the varied sizes and damaged threads encountered in many parks, the threaded coupling 87 is not always satisfactory. The coupling 86 is the least preferable, however, there are a few non-threaded horizontal park sewer receptors that will require the above type coupling for some undetermined future.

The coupling 85 is the most preferred type in view of its quick plug in and out connection to the park sewer receptor, the anti-retraction feature, the water tightness and the close proximity to the grade level thereby providing a maximum drainage slope and accessibility to the preferred vertical sewer receptor, which has been approved by the State of California.

The terminal cap 97 (FIGS. 1 and 9) is provided with a neoprene O-ring 98 to effect a drip and odor proof seal when engaged to the distal end of the interchangeable coupling. The cap 97 is secured to the telescopic tube handle 79, by the lanyard 99.

The coupling 87 is further provided with an annular lip 95 to receive the above mentioned terminal cap 97.

Sink and Bath Drain Holding Tank Assembly

Referring now to FIGS. 3 and 6, the sink and bath drain holding tank, comprises a double deck container constructed of fiber glass or other suitable material. The upper level consists of a bathtub 105 and the lower level consists of a drain holding tank 106. The tank 106 is provided with transverse and longitudinal baffles 107 and 108, respectively, which relate to a series of rectangular interconnected boxes which are open at the top and bottom. The feet 109 are integral with and support the baffles 107 and 108 at a suitable height above the bottom, botton, thereby permitting gradual equalization of the drain water within the tank 106. The top surface of the baffle plates 107 and 108 are provided with grooves 67 to permit air equalization and further to provide a supporting structure for the bathtub 105. The vent pipe 68 (FIG. 7) provides for gas escape and pressure equalization for the tank 106.

The vent pipe 68 is secured to the access plate 111 which in turn is secured to the end wall of tank 106 by means of the embedded stainless steel retaining ring 112, integral studs 113 and retaining nuts 114. The access plate 111 provides access for the clearing of obstructed drains, repairs or replacement to the non-return valve 117, which is constructed of neoprene or other suitable resilient material. The valve 117 is secured to the conventional drain trap 116 by the hose clamp 118. The above arrangement permits the flow of the tub drains into the holding tank 106, but prevents their return.

The above mentioned baffle plate assembly can be related to the conventional ice cube tray, in that the baffle plates subdivide the water content into individual non-tight cells, thus permitting a gradual ingress or egress of the drain water between the adjacent cells. The above mentioned restriction to flow will diminish the wave action of the accumulated drain waters, thereby reducing the magnitude of the upsetting moments of force created by the free surface effect of the fluid in motion, thereby providing a safer holding tank for recreational vehicles and the like.

Sink and Bath Drain Transfer Assembly

Referring now to FIGS. 2 and 3, the sink and bath drain transfer assembly, comprises a main drain line 124 common to the holding tank drain line 121, lavatory sink drain line 122 and the kitchen sink drain line 123. When the vehicle is parked the cross connection valve 125 is manually opened by reach rod 126, permitting free communication of the sink and lavatory drains with the holding tank drains. The valve 125 is secured while traveling to isolate the holding tank 106 to prevent possible surging of the drain water into the sink and lavatory.

It appears feasible to install vertical non-return valves in the drain lines 122 and 123, to prevent back surging in lieu of the manual cut out valve 125.

The reach rods 29 and 126 previously mentioned are protected from damage by the vehicle bumper 32 and could be enclosed to prevent unauthorized use.

When the vehicle is hooked up to a park sewer receptor, the accumulated sink and bath drains may be diverted into the toilet holding tank drain line 25 through cut out valve 130 which is operated by reach rod 131 located in locker 2 (see also FIG. 1) thence through the horizontal swing check valve 132, in turn through nipple 133, thence discharging into the elbow 27 of the toilet holding tank drain line assembly, as previously described.

When the vehicle is parked at a campsite in which sewer hookups are not available, the accumulated drains may be diverted through the drain valve 135 thereby controlling the flow of the drain water into a

catch bucket for ultimate carrying to a designated disposal station. The terminal cap **136** is secured to the valve **135** when not in use to prevent unauthorized draining.

Potable Water Holding Tank Assembly

Referring now to FIG. **2**, the potable water holding tank **140** is rectangular in plan and comprises an identical baffle plate system with commensurate safety features as previously described for the sink and bath drain holding tank **106**. The exterior plating of the tank **140** is provided with the conventional filling and discharge pipe connections.

Electrical and Potable Water Transfer Assembly

Referring now to FIGS. **1** and **2**, the inboard ends of the electric entrance cable and the potable water hose **145** and **146** respectively, are secured to the vehicle frame **31** as by clamps (not shown) to prevent total withdrawal from their respective carrying tubes **147** and **148**. The cable **145** and hose **146** are resilient and preformed into helical coils which inherently bias themselves into contracted states. The above arrangement provides a self-storing feature, facilitating withdrawal and self-recoil into their respective carrying tubes. The carrying tube cover doors **149** and **150** are hinged at **151** and **152** respectively. The recesses **143** are provided in the bottom overhang of the tubes **147** and **148** to receive the cable **145** and hose **146** after a sufficient length has been withdrawn to reach the park electric and water receptors. The doors **149** and **150** are then closed and locked to retain the unused coils within the carrying tubes, which are not required for that particular hookup. The above locking arrangement provides an adjustable means to maintain adequate tension on the cable and hose to permit self-support above the contaminated ground level. A lanyard may be required to secure the electrical plug of the cable **145** to some of the older type park receptors.

Referring now to FIG. **10**, the adapter **154** provides a means to facilitate connecting and disconnecting the quick change coupling **144** attached to the distal end of the hose **146** to the conventional park garden hose valve.

The adapter **154** comprises a standard garden type threaded female coupling **155**, a hose gasket **156** and the male portion **157** of the standard quick change coupling. The adapter **154** is further provided with finger tightening spokes **158** to facilitate tightening the adapter to the park water valve. The adapter is further provided with a retaining ring **159** which in turn is secured to the hose **146** by lanyard **160** to prevent loss. The above adapter will be required until national standardization of the park water valves are provided with the male portion of the quick change coupling. The conventional precoiled nylon air hose **146** and its attached quick change coupling **144** are readily adaptable for use as a recreational vehicle water hose, in addition the female portion of the quick change coupling serves as a non-return check valve to retain the water pressure in the vehicles potable water system when disconnected from the male portion of the adapter **154**.

The foregoing electrical and water transfer assembly eliminates the need to disconnect the water hose from the vehicle water system, and further to preclude the need to wash, tie and stow the cable and hose in a conventional locker, amid other entangled paraphernalia, thus transforming a dirty discomforting job into a clean expeditious task.

Modified Toilet Holding Tank Drain Assembly

FIG. **11** illustrates a modified telescopic toilet holding tank drain assembly constructed of ABS plastic or other suitable material. The components having their counterparts in the first embodiment of the invention are identified by the same reference numerals and only those features requiring a change of parts are identified by new reference numerals of the "200" series. The principal change is in the water tight structure of the telescopic tubes and their supporting vertical and horizontal rotatable elbows, which provide the required flexibility for alignment with the park receptor, and further provides for the proper gravitational draining and stowage for traveling in a like manner described in the first embodiment of the invention. The telescopic tube assembly T, comprises an elbow **200** with an integral handle **201**. The elbow **200** is secured to the distal end of the telescopic tube **202**, which the latter in turn is slidably engaged within the telescopic tube **203**, the latter in turn is slidably engaged within the supporting tube **204**. The water tight integrity is achieved between the telescopic tubes by the means of a slidingly engaged neoprene stop and guide ring **206** which is secured in an annular recess **205** on the upstream end of the telescopic tube **203**. The ring **206** is provided with a conical inlet **209**, to minimize the restriction of flow, and to prevent the accumulation of waste particles. The ring **206** fits snugly against the inner wall of tube **204** and in conjunction with the peripheral grooves **207** and the lands **208** provide a water tight means, permitting the extension and retraction of the tube **203** within the tube **204**. A threaded terminal bushing **210** is secured to the distal end of the tube **204**. The bushing **210** is further provided with integral stop and guide rings **211** and **214**. The extension of tube **203** is terminated when the stop and guide ring **206** strikes the stationary stop and guide ring **214**, thereby providing suitable overlap between the tubes **203** and **204** for mutual support. The threaded end portion of ring **210** receives the hand tightened ring nut **212**, which in turn is provided with an O-ring **213**, which the latter in turn is seated against the stop and guide ring **211**. An annular recess **215** is provided between the stop and guide rings **211** and **214** to reduce frictional contact with the slidably engaged tube **203**. The hand tightened ring nut **212** is tightened when the tube **203** has been extended to the desired length thus insuring maximum water tight integrity from any small quantity of water that may have leaked past the stop and guide ring **206**. The stop and guide rings **206**, **211** and **214** further provide support and concentric guidance for the tube **203**.

An identical water tight sealing assembly as described above is installed between the telescopic tubes **202** and **203**, but are not described or illustrated in the interest of brevity. If and when the standardization of the park sewer inlets become more exacting, only one telescopic section may be required in lieu of the two sections mentioned above.

The supporting tube **204** is secured to the threaded end of the elbow **220** and made water tight by O-ring **221** or other suitable gasket material. The elbow **220** is rotatably engaged to nipple **223** and secured thereto by the retaining bolt **224**. The distal end of the bolt **224**

rotates within the annular groove 225 of the nipple 223. A water tight seal is provided between the rotatable elbow 220 and the fixed nipple 223 by the means of a pair of O-rings 227, thus permitting the elbow 220 and the attached telescopic tube assembly, to rotate horizontally about the fulcra nipple 223, for appropriate alignment with the park receptor. The nipple 223 is secured to the elbow 230, which in turn is secured to the nipple 231 (partially shown) in an identical manner as previously described for the rotatable end of the elbow 220. The vertical rotation of elbow 230 about its fulcra nipple 231, enables the telescopic tube assembly to be transited from the draining to the stowage position as previously described in the first embodiment of this invention. The nipple 231 is secured to the elbow 232 which in turn is secured to the nipple 233 which the later in turn is supported by bracket 234. The bracket 234 should be secured to nipple 231, however for purposes of clarity it is attached to the nipple 233. The bracket 234 is secured to the vehicle frame 31. The nipple 233 is secured to the elbow 27, which in turn houses the water wash down jet assembly J as previously described in the first embodiment of this invention.

The above arrangement facilitates handling, connecting, disconnecting, draining, washing and stowing of the toilet holding tank drain transfer assembly, in addition it further provides for adequate water tight integrity, supported drain incline and the flexibility required to achieve its prescribed function. In the event that future standardization may require the recreational vehicle toilet drain line to be threadedly engaged to a park receptor, comprising a 90° elbow, connected to a vertical sewer stand pipe, the necessary provisions have been made in this invention to modify the terminal coupling as provided for in FIG. 12, comprising a threaded ball socket 233, secured to the distal end of the telescopic tube 202. The hand tightening nut 234, is threadedly engaged to the ball socket 233. An O-ring 235 is secured within an annular recess in the ball socket 233, to effect water tight integrity between the socket and the ball 236 when compressed by the ring nut 234. Integral with the hollow ball 236 is a hollow shaft 237, the latter in turn is externally provided with the hand tightening grooves 238 and standard pipe threads 239 for engagement to the park threaded elbow receptor.

In the event that standardization should turn toward a vertical park sewer receptor, requiring a threaded connection, the elbow 200, previously described, could be mutually modified to receive the above mentioned ball socket 233, in order to vertically orient the axis of the ball shaft 237 for engagement of its threaded end portion 239 to the vertical park sewer receptor.

Modified Jet Assembly

FIG. 13 illustrates a modified water wash down jet assembly. The components having their counterparts in the first described embodiment of the invention are identified by the same reference numerals and only those features requiring a change of parts are identified by new numerals of the "300" series. The principal change is that the combination jet and non-return valve 301, is a substitution for the swing check valve 49, the diffuser ball 36 and the strainer plate 37. The valve 301 is shown in the open position, as caused by the exertion of the wash-water pressure. The valve 301 is provided with the tangential orifices 302 and a diffuser cone 303 which impart a whirling motion to the water wash spray cone. The valve 301 is slidably engaged with the valve body 304, wnich has a conical outlet that provides a seat for the diffuser cone 303. When the potable water cut out valve 46 is secured, the valve 301, will be automatically urged into a closed position by the coil spring 305, thus preventing the entry of waste particles into the jet orifices 302.

Although two exemplary embodiments and modifications of the invention have been disclosed herein for purposes of illustration, it will be understood that various other changes, modifications and substitutions may be incorporated without departing from the spirit of the invention as defined by the claims which follow.

I claim as my invention:

1. In a tank draining system, the combination of:
   a. a tank having a drain;
   b. telescoping conduit means;
   c. swivel means mounting said conduit means for swiveling movement relative to said drain;
   d. said swivel means including a swivel plate fixed relative to said tank, and a swivel bracket pivotally connected to said swivel plate for pivotal movement about a vertical axis;
   e. said swivel means further including hinge means fixedly connected to said conduit means and pivotally connected to said swivel bracket for pivotal movement about a horizontal axis perpendicular to and intersecting said vertical axis; and
   f. an extensible and contractible hose in said conduit means and connected at one end to said drain.

2. A tank draining system according to claim 1 including means for injecting a flushing liquid into said drain.

3. In a tank draining system, the combination of:
   a. a tank having a drain;
   b. telescoping conduit means connected to said drain;
   c. swivel means mounting said telescoping conduit means for swiveling movement relative to said drain;
   d. an extensible and self-contractible helical hose within said telescoping conduit means;
   e. said hose being connected at one end to said drain;
   f. said hose having connected to its other end a fitting detachably connected to the outer end of said telescoping conduit means, whereby said fitting may be detached from said telescoping conduit means to permit extension of said hose and withdrawal of said hose from said conduit means; and
   g. said hose embodying self-contracting means biasing it into said telescoping conduit means, whereby said hose will retract itself into said telescoping conduit means upon being withdrawn therefrom and released.

4. A tank draining system according to claim 3 including means for injecting a flushing liquid into said drain.

* * * * *

United States Patent [19]

Irwin et al.

[11] 3,882,565

[45] May 13, 1975

[54] SPRING FEED DEVICE

[75] Inventors: **Lawrence F. Irwin**, Calabasas Park; **Fritz O. Ehrler**, Panorama City, both of Calif.

[73] Assignee: **Lawrence F. Irwin**, San Fernando, Calif.

[22] Filed: **Nov. 30, 1973**

[21] Appl. No.: **420,527**

[52] **U.S. Cl.** .... **15/104.3 SN**
[51] **Int. Cl.** **B08b 9/02**
[58] **Field of Search** .... 15/104.3 R, 104.3 SN; 254/134.3 FT; 226/25

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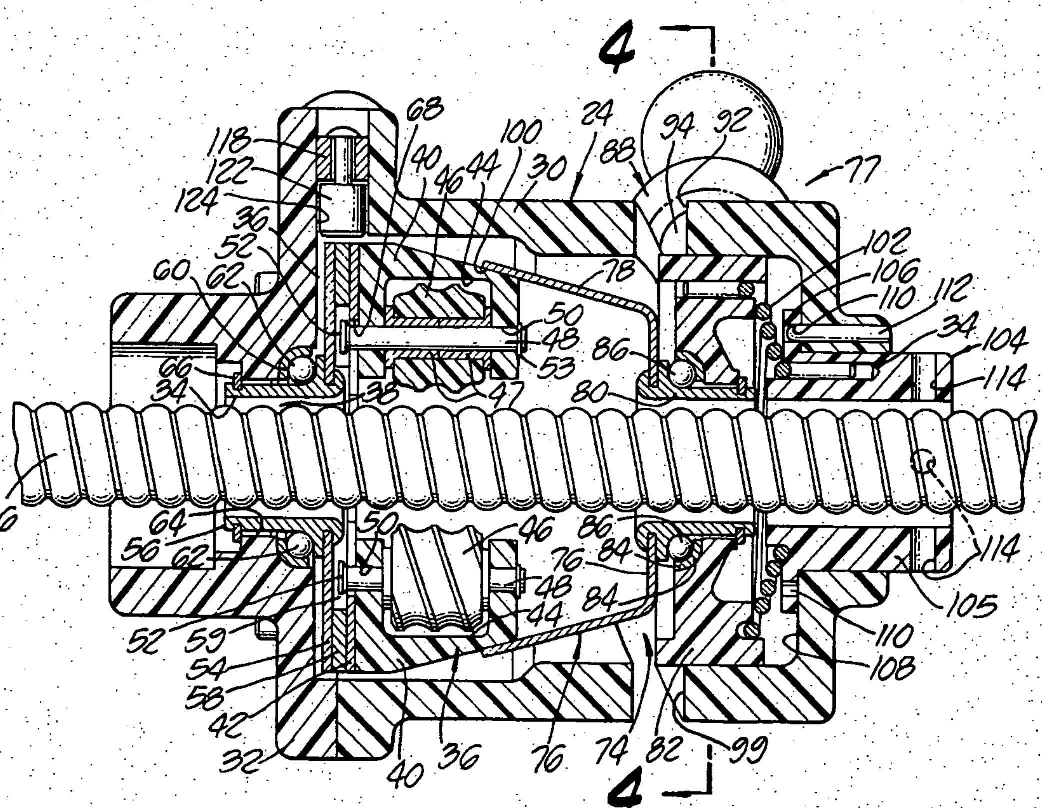
Primary Examiner—Edward L. Roberts
Attorney, Agent, or Firm—Whann & McManigal

[57] **ABSTRACT**

A feed control apparatus for use in conjunction with a plumbing tool of the type used for cleaning and removing obstructions from drain pipes in which an elongated coiled spring wire, or plumber's snake, is advanced through the pipe and rotated. The feed control apparatus includes a novel combination snake feed and chucking device which supports the rotating snake at all times and automatically controls the rate of feed of the snake through the pipe in accordance with the resistance encountered. Upon the snake encountering a blockage in the pipe which results in torque buildup in the snake, the rate of feed will be automatically slowed to permit the snake to work its way past the obstruction. If the blockage cannot be penetrated so as to permit further advance of the snake, the rate of feed will automatically be reduced to zero, thereby preventing damage to the equipment or possible injury to the operator.

16 Claims, 8 Drawing Figures



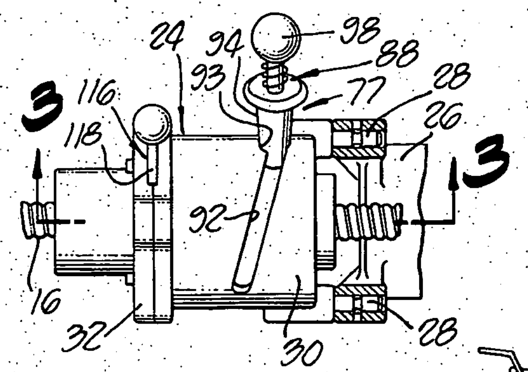


FIG. 2.

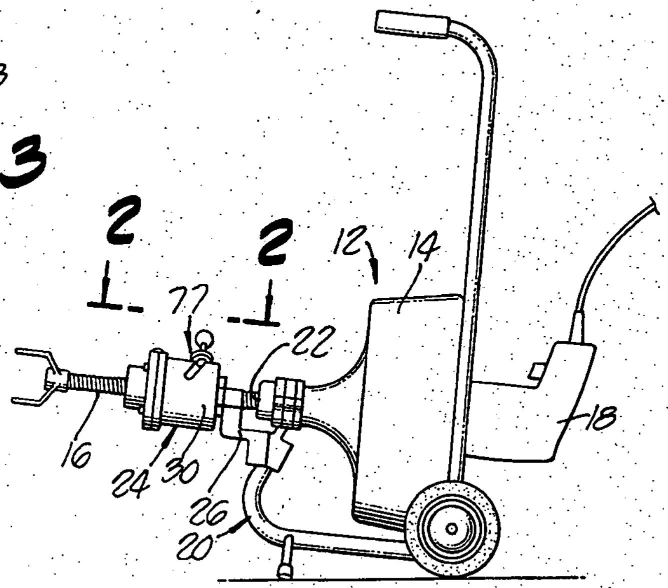


FIG. 1.

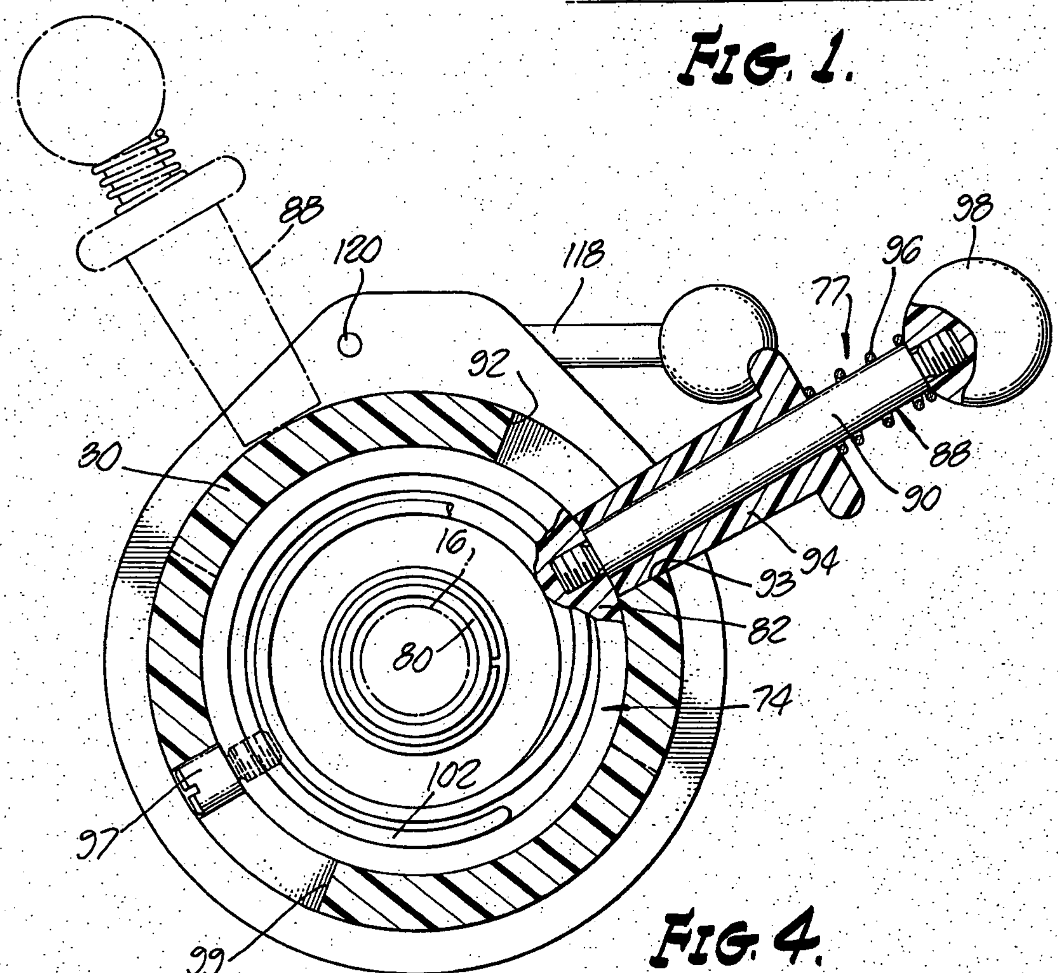


FIG. 4.

FIG. 3.

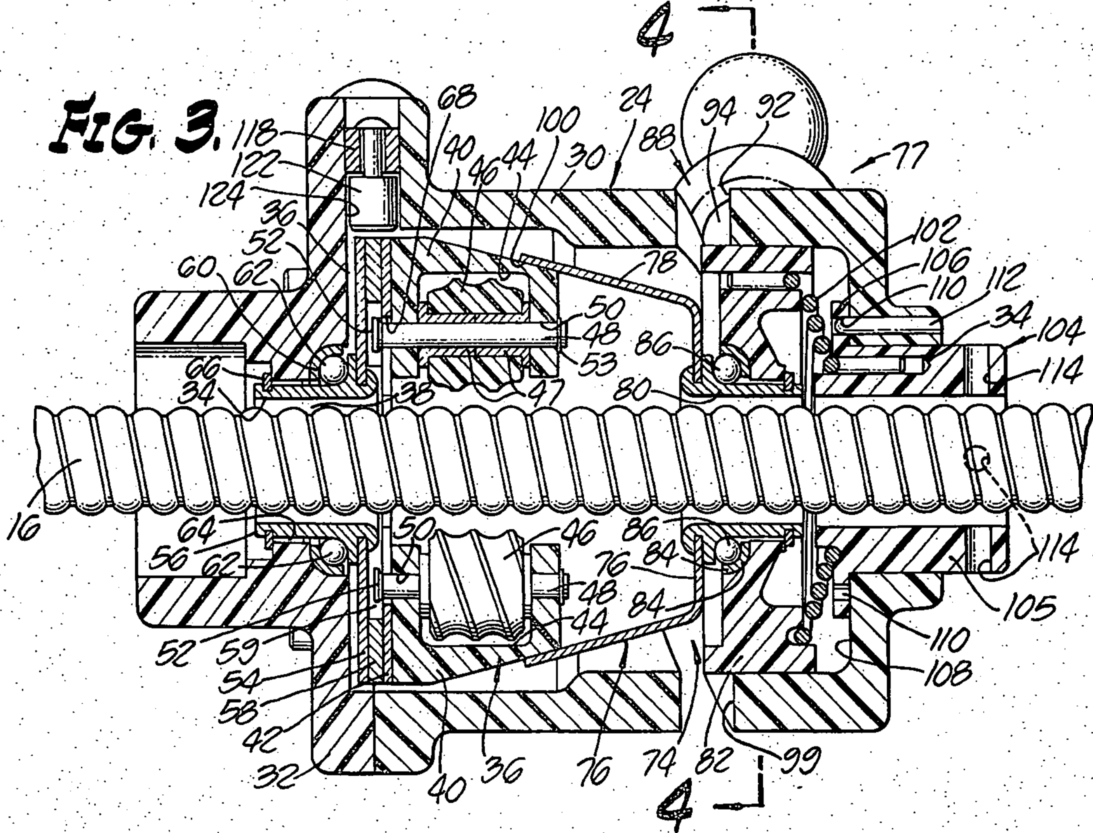

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FIG. 5.

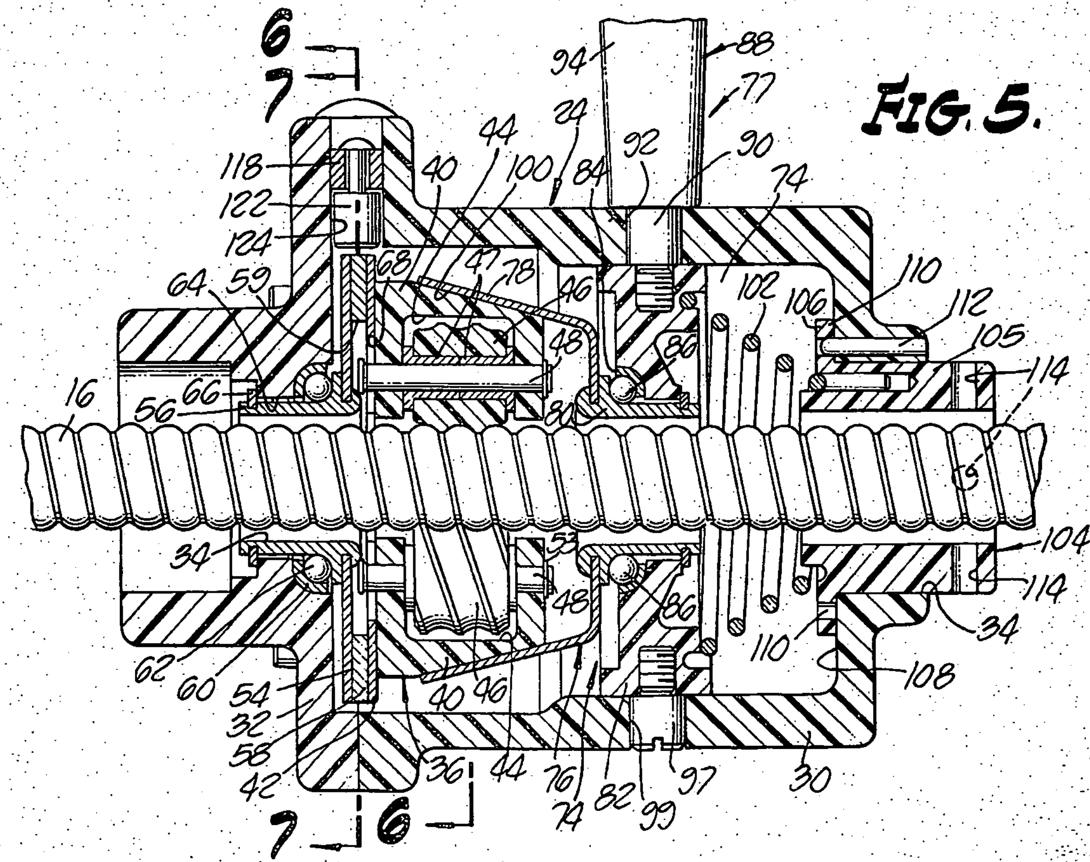
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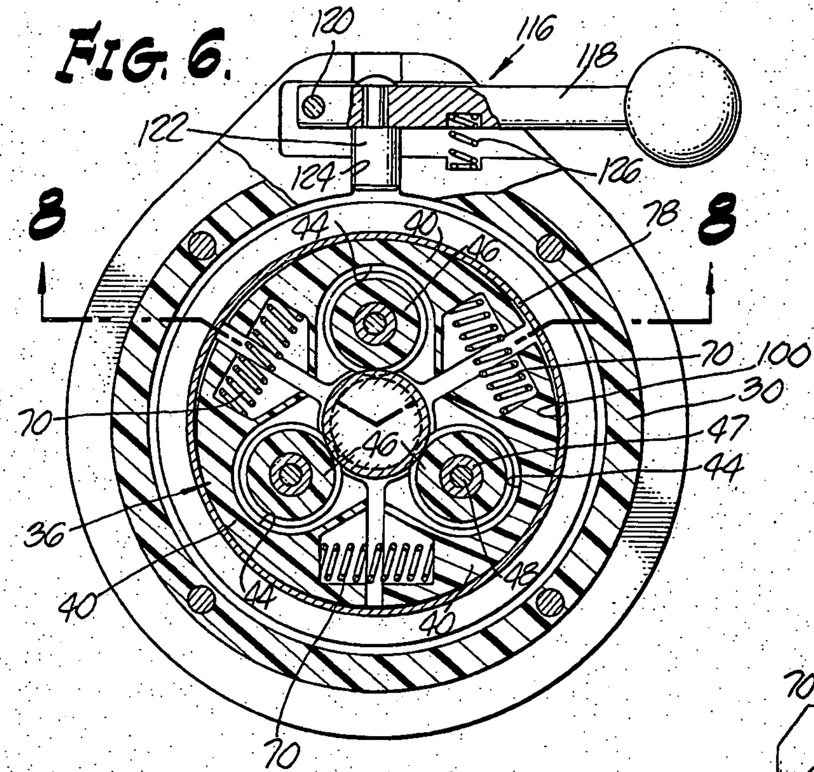
FIG. 6.



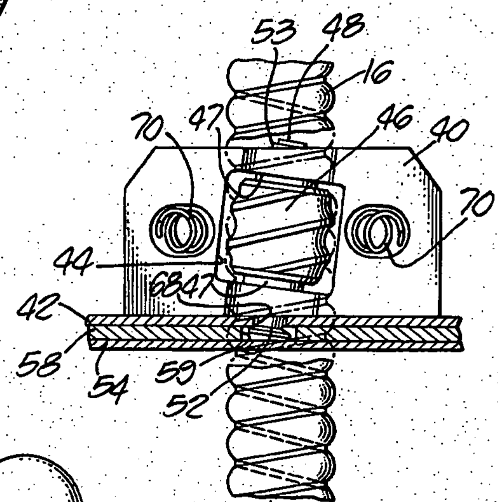
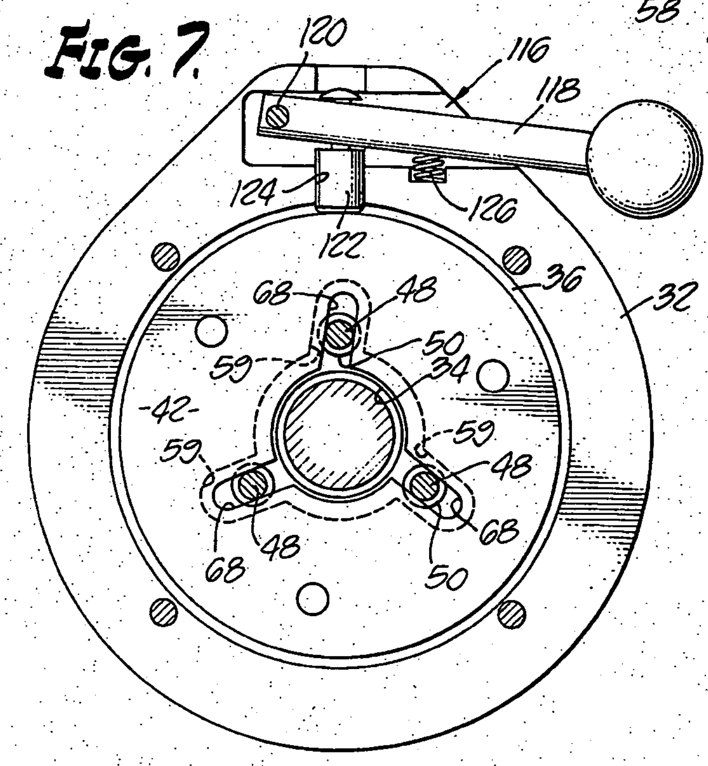


FIG. 8.

FIG. 7.



SPRING FEED DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention has to do generally with plumbers tools used for cleaning and removing obstructions from drain pipes and utilizing an elongated member in the form of a coiled spring wire, known as a plumbers snake, which is advanced through the pipe and rotated. More particularly, the invention relates to the provision of a novel, automatic feed device which will accommodate springs or snakes of various diameters, will accommodate distortions in the spring and will automatically vary the rate of axial feed of the spring relative to the impedance encountered by the spring as it advances through the pipe.

2. Discussion of the Prior Art

Spring-type plumbers snakes are ordinarily housed in a drum or container having a conoidal wall through which the spring or snake is fed and retracted axially of itself as the container is rotated to cause rotation of the spring. In conventional tools having power-operated spring advancing and retracting means, the feed mechanism typically includes a jaw in the form of a segmented nut, or the like, through which the spring is fed by rotating it so that, in effect, the spring is threaded through the jaw. Since the jaw is stationary, the rate of feed of the spring or snake is entirely dependent upon its speed of rotation. Further, the stationary jaw cannot accommodate irregularities in the spring such as kinks, couplings and the like and if such irregularities are encountered, serious damage to the equipment can result. Also, should the spring or snake encounter a restriction within the pipe which it cannot immediately penetrate, the driving torque will build up against the stationary jaw causing the snake to kink and frequently break, thereby creating a significant safety hazard.

Various attempts have been made in the past to design a snake feed device which would permit the operator to quickly stop the feed should a blockage be encountered within the pipe. Among the most successful of these prior art devices are the devices invented by Hunt, et al., and described in U.S. Pat. Nos. 2,769,191, 3,224,024 and 3,499,782. These devices, while clearly superior to similar units on the market, nevertheless have the drawback that the feed jaws cannot accommodate any appreciable distortion in the spring and the feed of the spring is controlled entirely by the operator. Unless the operator is continuously alert to any indication of impedance to forward feed of the spring within the pipe, and quickly responds by stopping the feed, the buildup of driving torque can cause serious damage to the equipment and possibly injure the operator as well.

The novel construction of the device of the present invention solves the aforementioned problems by providing a novel spring loaded combination snake feed and chucking device which can readily accommodate distortions or couplings in the snake and additionally automatically regulates the rate of feed of the snake from zero to approximately 12 feet per minute depending upon the impedance encountered by the snake. For example, upon encountering a blockage in the pipe which results in a torque buildup in the snake and an impedance to further forward feed, the rate of feed will be automatically slowed to permit the snake to work its way past the obstruction. If the blockage is such that the snake cannot penetrate it, the impedance to forward movement of the snake is immediately sensed by the feed device and the rate of feed is instantly reduced to zero without any corrective action being required of the operator. In this way, the safety of the operator is assured and damage to the snake or to other parts of the equipment is prevented.

In addition to the patents to Hunt, et al., previously identified, applicant is aware of the prior art patent to Turnbaugh, U.S. Pat. No. 2,600,707, which is clearly distinguishable from the present invention.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a plumbing tool of the type which uses an elongated coiled spring wire, or snake which is rotated and fed into drain pipes and the like, in which there is provided a novel spring loaded combination chucking and snake feed mechanism which continuously supports the rotating snake and which, during the feed mode, automatically controls the rate of feed of the snake into the pipe in accordance with the degree of impedance encountered by the snake as it is fed into the pipe.

It is another object of the present invention to provide a device of the aforementioned character in which the feed mechanism automatically adjusts to various coiled spring, or snake, diameters and to widely varying conditions of snake distortion.

It is another object of the invention to provide a tool of the class described in which the feed mechanism can function as a chucking device to rotatably support the snake during a dwelling mode, i.e., at zero feed, and can be expeditiously activated to a feed mode whereby the snake can be controllably fed in a forward or reverse axial direction relative to the feed mechanism.

It is still another object of the invention to provide a device of the aforementioned character in which the feed mechanism includes snake engaging elements movable into and out of driving engagement with the snake and further includes a biasing mechanism for yieldably urging the snake engaging elements into driving engagement with the snake which is so constructed and arranged as to permit the elements to move out of driving engagement with the snake in response to forces opposing feeding of the snake axially of itself.

It is a further object of the invention to provide a device as described in the preceding paragraph in which the biasing mechanism is adjustable so that the force exerted thereby to hold the snake engaging elements in driving engagement with the snake may be controllably varied.

More particularly, it is an object of the invention to provide a novel feed mechanism embodying a plurality of arcuately spaced radially movable rotating feed rollers which can be moved into and out of driving engagement with the rotating snake. The mechanism is constructed so that when the feed rollers are in engagement with the snake, the entire assembly can function as a chucking device and rotate with the snake. Alternatively, the rotation of the mechanism can be stopped, thereby causing the feed rollers to rotate in an opposite direction relative to the rotation of the snake. Because the feed rollers rotate relative to the snake and because they are constructed with specially configured helical grooves about their periphery, the snake will be fed at a significantly advanced rate of speed as compared with a standard stationary jaw type device.

It is still another object of the invention to provide a device as described in the preceding paragraph in which the feed rollers of the feed mechanism are movable radially outwardly relative to the snake against the urging of a biasing means operatively coupled with the feed mechanism and adapted to normally urge the rollers into engagement with the snake. This unique construction permits the feed mechanism to automatically sense and effectively accommodate torque buildup and distortions of the snake.

It is a further object of the invention to provide a novel, low-cost, lightweight, continuous chucking, automatic feed apparatus which is relatively simple in design, can be readily attached to tools presently on the market, and is extremely durable and reliable in operation.

In summary, these and other objects of the invention can be accomplished by a feed control apparatus for use with plumbing tools of the type having an elongated coiled spring wire or plumbers snake and a mechanism for rotating the snake about its longitudinal axis comprising a snake engaging subassembly movable into and out of driving engagement with the snake, an operating subassembly operably coupled with a snake engaging subassembly for moving the snake engaging subassembly into driving engagement with the snake, and a biasing subassembly operably coupled with the operating subassembly for yieldably urging the operating subassembly into driving engagement with the snake. The biasing subassembly is so constructed and arranged as to permit the snake engaging subassembly to move out of driving engagement with the snake in response to forces opposing feeding of the snake axially of itself.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the plumbing tool of the invention including the automatic plumbers snake feed control device.

FIG. 2 is a slightly enlarged view taken along lines 2—2 of FIG. 1 showing the plumbers snake feed control device of the invention.

FIG. 3, taken along lines 3—3 of FIG. 2, is a greatly enlarged cross-sectional view of the feed control device of the invention as it appears at rest.

FIG. 4 is a cross-sectional view taken along lines 4—4 of FIG. 3 partly broken away to show internal construction. The phantom lines in FIG. 4 illustrate the position of the control lever of the feed control device when the device has been actuated.

FIG. 5 is a cross-sectional view similar to FIG. 3, but showing the appearance of the parts of the device after it has been actuated to bring the feed rollers thereof into operable engagement with the rotating snake.

FIG. 6 is a cross-sectional view taken along lines 6—6 of FIG. 5.

FIG. 7 is a cross-sectional view taken along lines 7—7 of FIG. 5, but shown with the stop lever in its actuated, or downward, position.

FIG. 8 is a cross-sectional view taken along lines 8—8 of FIG. 6.

DESCRIPTION OF ONE EMBODIMENT OF THE INVENTION

Referring to the drawings, FIG. 1 shows the plumbing tool of the invention generally designated by the numeral **12**. The tool includes a snake housing **14** in which may be coiled a plumbers snake **16**, shown as a tightly coiled spring wire or cable. The housing **14** has mounted thereon a reversible electric motor **18** which is used for rotating the housing and the coiled spring or snake encased therein, either in a clockwise or counterclockwise direction. The housing and the motor are mounted on a wheeled cart **20** for ease of transport and are interconnected in a conventional manner to permit controlled rotation of the housing. Snake housing **14** is provided with an opening **22** which is concentric with the axis of rotation of the housing and through which the rotating coiled spring **16** may be fed.

The automatic feed control apparatus of the invention, generally indicated by the numeral **24**, is located forwardly of the snake housing and, as shown in FIG. 2, is affixed to a bracket **26** on cart **20** by means of threaded studs **28**.

Turning now particularly to FIGS. 2, 3 and 4, the feed control apparatus of the invention can be seen to include a transmission housing **30** having a forward cover plate **32**. The housing and cover plate, which are removably interconnected by threaded connectors or the like, may be constructed of a durable metal or plastic material and are provided with an axial passageway **34** coaxially disposed with respect to opening **22** in the snake housing **14**.

A first means, which functions as a combination chucking and feed mechanism, is generally designated by the numeral **36**. First means **36** is rotatably carried by housing **30** and is adapted to supportably engage the rotating snake **16**. In the embodiment of the invention illustrated in the drawings, means **36** comprises a snake engaging means movable into and out of operable engagement with the snake for supporting the rotating snake during the dwell mode and for controllably feeding the snake in an axial direction during the feed mode, and support means for carrying the snake engaging means rotatably within housing **30**. The snake engaging means is provided with an axial passageway **38** concentric with passageway **34** for reception of the snake **16** and includes a plurality of arcuately spaced radially movable segments **40** disposed in slidable engagement with a rear, generally circular shaped, support plate **42** which plate forms a portion of the support means of first means **36**.

As best seen by referring to FIGS. 3 and 6, each segment **40** of the snake engaging means is provided with a concave cavity portion **44** adapted to accommodate a snake driving means depicted here in the form of specially configured feed rollers **46**. Each feed roller is generally cylindrical in shape and has a plurality of helical grooves formed on its outer periphery which are adapted to matably engage the coils of the coiled spring wire or snake. As shown in FIG. 3, each feed roller **46** is provided with bushings **47** and is rotatably mounted on an axle member **48** which, in turn, is rotatably supported in coaxial bores **50** formed in each segment **40**. Axle member **48** has an enlarged diameter head **52** at one end and a keeper ring **53** near its opposite end. Keeper ring **53** serves to locate the axle longitudinally of the segment **40**.

Each segment **40** along with its rotatably mounted feed roller **46** is supported within housing **30** by a support means shown here as comprising, in addition to the previously mentioned rear support plate **42**, a generally circular forward support plate **54** carried by a rotating spindle member **56** and a generally circular intermediate or spacer plate **58**. Spacer plate **58** is provided

with a plurality of radially outwardly extending slots **59**, the purpose of which will be discussed shortly. Provided within bearing ways **60** formed in cover plate **32** are roller bearings **62** adapted to rotatably support the spindle member **56**. Spindle member **56** has an inside diameter slightly larger than snake **16**, an outside diameter slightly smaller than the axial passageway **64** formed in cover plate **32** and is held in position within passageway **64** by a ring member **66**. Plates **42**, **54** and **58** are suitably interconnected together by rivets or the like and cooperate to operatively support segments **40** so that the entire assembly thus formed can rotate freely about the longitudinal axis of housing **32**.

As shown in FIG. **3**, when the feed means is assembled together, the enlarged diameter head portion **52** of each axle member **48** is disposed between forward support plate **54** and the rearward support plate **42** and within slots **59** formed in the spacer plate **58**.

Referring to FIG. **7**, which is a view more clearly illustrating the configuration of support plate **42**, it can be seen that each axle member **48** of the feed means protrudes through a guide slot **68** formed in support plate **42**. The guide slots **68** in plate **42** extend outwardly from the longitudinal axis of the assembly in the same manner as the slots **59** formed in spacer plate **58**, but have a width only slightly larger than the diameter of the axle **48** and somewhat smaller than the diameter of the head portion **52**. With this construction it can be seen that when keeper rings **53** are in place on axles **48**, the radially extending forward faces of segments **40** are held in slidable engagement with the rearwardly facing surface of support plate **42**. Because of the spacing between the support plates and due to the configuration of the slots **68**, which act as guides to the axles **48**, each segment **40** is free to move radially inwardly and outwardly relative to the snake **16**. In this way, the feed rollers **46** carried by segments **40**, may be selectively moved into and out of operative engagement with the snake **16**.

Referring now to FIG. **6**, it can be seen that the snake engaging means also includes a first biasing means, shown here in the form of coil springs **70**, disposed between segments **40**, which biasing means is provided for yieldably resisting inward radial movement of segments **40** so as to normally hold the feed rollers **46** out of engagement with the snake in the manner shown in FIG. **3**. To bring the feed rollers **46** into operative engagement with the snake **16**, it is necessary to move segments **40** radially inwardly against the urging of the first biasing means. This is accomplished by a second or operating means generally designated by the numeral **74**. Second means **74**, which is operatively coupled with first means **30**, comprises interengaging means **76** rotatably carried within housing **30** and movable into mating engagement with first means **36** for moving the snake engaging means of the first means into operative engagement with the snake **16**. As best seen in FIG. **4**, second means **74** also includes a control means **77** cooperatively associated with housing **30** for operating interengaging means **76**.

In the form of the invention shown in the drawings, interengaging means **76** includes a generally conical shaped member **78** (FIG. **3**) which is rotatably carried within housing **30** by a rotating spindle member **80**. Provided within a ring shaped loading member **82** which is carried within housing **30** and which forms a part of control means **77** are bearing ways **84** adapted to carry roller bearings **86** which function to rotatably support spindle member **80**. As illustrated in FIG. **5**, loading ring **82** is movable longitudinally of housing **30** by means of a control rod assembly **88** which, in this embodiment of the invention, also forms a part of control means **77**.

Referring to FIGS. **2** and **4**, control rod assembly **88** can be seen to comprise a control rod **90** threadably connected to loading ring **82** and extending radially outwardly from housing **30**. Control rod **90** is movable with respect to housing **30** along a prescribed arcuate path defined by a curved slot **92** (FIG. **2**) formed in housing **30**. Because of the shape of slot **92**, movement of control rod **90** within slot **92** results in the movement of loading ring **82** forwardly and rearwardly within housing **30**. Control rod assembly **88** also includes a sleeve member **94** (FIG. **4**), a biasing spring **96** and a spherically shaped handle element **98** affixed to control rod **90**. When the control rod assembly is in the locked position, as shown by the solid lines in FIG. **4**, the lower end of sleeve **94** is closely received within a cylindrically shaped opening **93** which is formed in housing **30** at one extremity of slot **92**. To enable the control rod to be moved into the position shown by the phantom lines in FIG. **4**, which in turn moves the loading ring **82** forwardly of housing **30**, the sleeve **94** must be raised against the urging of spring **96** until it clears spring **93**. A threaded set screw **97** is threadably connected to loading ring **82** at a location diametrically opposed to rod **90**. Set screw **97** is adapted to move within a second slot **99** formed in housing **30** and serves to hold the control assembly in proper alignment so as to prevent cocking and possible binding of control rod **90** in slot **92**.

As illustrated in FIGS. **3** and **5**, segments **40** of first means **36** cooperate to form a generally frustoconical shape having inwardly sloping sides **100** adapted to mate with the inner surfaces of members **78** of second means **74**. With this construction, when the control rod assembly is released from its locked position and loading ring **82** is moved forwardly or to the left of housing **30** to the position shown in FIG. **5**, segments **40** will in turn be moved radially inwardly due to the camming action of member **78**. As shown in FIG. **5**, this will result in rollers **46** moving into operable engagement with the snake or coil spring **16**. With the device in the configuration shown in FIG. **5**, and with the snake **16** rotating about its longitudinal axis, interengaging means **76**, along with first or chucking means **36**, will rotate freely about the longitudinal axis of housing **30**. In this mode of operation, called the dwell mode, the snake **16** is held in a chucking relationship and will move neither forwardly nor rearwardly with respect to housing **30**.

An important feature of the present invention is the provision of a second biasing means cooperatively coupled with the first and second means **36** and **74** for normally holding the snake engaging means in driving or feeding engagement with the snake. In the form of the invention shown in the drawings, the second biasing means comprises a conically shaped coil spring **102**. As will presently become clear, the second biasing means is responsive to forces resisting feeding of the snake so as to permit the snake engaging means to move out of normal driving engagement with the snake in response to such forces. As illustrated in FIGS. **3** and **5**, the second biasing means or spring **102** is constructed and arranged so as to continuously urge conical member **78**

of second means 74 into operable engagement with segments 40 of first means 36. In this way, the rollers 46 of the snake engaging means are continuously, but yieldably, urged into frictional driving engagement with snake 16.

The second biasing means of the invention also includes an adjustment means for adjusting the loading of the second biasing means or spring 102. As shown in FIG. 3, in this form of the invention the adjustment means includes an adjusting ring 104 which is slidably received within the axial passageway 34 formed in housing 30. Ring 104 has a shank portion 105 and a radially extending flange portion 106 at its left or forward extremity which normally engages the end wall 108 of housing 30. This flange portion is provided with a plurality of arcuately spaced holes 110 adapted to receive a locking pin member 112 carried by end wall 108 and extending a short distance into housing 30. As shown in FIG. 3, one extremity of spring 102 is connected to loading ring 82 and the other end is connected to adjusting ring 104. The shank portion 105 of ring 104 extends rearwardly from housing 30 and is provided with a plurality of openings 114 adapted to receive a tool such as a spanner wrench or the like for turning ring 104. To adjust the torque load on spring 102, ring 104 is forced inwardly into the housing a sufficient distance to clear the end of pin 112 and is then turned so as to either coil or uncoil spring 102. When the desired spring loading is achieved, inward pressure on ring 104 is relieved and the ring is turned slightly until the end of pin 112 falls into the nearest opening 110 formed in flange 106 of ring 104. It is to be understood that the greater the loading on the spring, the greater will be the resistance to rearward movement of interengaging means within housing 30. Stated another way, the greater the loading on spring 102, the greater will be the camming pressure exerted by cone member 78 against segments 40 and the greater will be the resultant gripping pressure exerted by rollers 46 against the coiled spring or snake 16.

Referring now to FIGS. 6 and 7, the stop means or feed control means of the invention is generally designated by the numeral 116. The purpose of the stop means is to permit the operator to stop the rotation of first means 36 and thereby cause the snake 16 to be fed forwardly or rearwardly of the housing depending upon the direction of rotation of the motor 18. As best seen in FIG. 7, in this form of the invention the stop means 116 comprises a lever arm 118 pivotally connected to housing 30 by means of a pivot pin 120. A piston 122 is connected to lever arm 118 and is adapted to be moved within a bore 124 formed in housing 30 and cover plate 32 into and out of braking engagement with first means 36 upon corresponding upward and downward movement of lever arm 118. A spring 126 is interposed between arm 118 and housing 30 to normally hold the lower arm in an upward position.

When the lever arm is in its normal upward position, as shown in FIG. 6, and the feed rollers 46 are in engagement with the rotating snake 16, first means 36, along with interengaging means 76, are free to rotate within housing 30. The tool is now in the dwell or chucking mode. When the lever arm 118 is moved downwardly into the position shown in FIG. 7, piston 122 is moved into frictional engagement with the support ring assembly of first means 36 causing the first means to stop rotating within housing 30. This will cause the feed rollers 46 to start to rotate in a direction opposite the direction of rotation of the snake and, due to the novel configuration of the helically grooved rollers, will cause the snake to be fed axially of itself at a rate proportional to the speed of rotation of the snake.

Turning to FIG. 8, it can be seen that the rollers 46 are mounted within segments 40 at a slight angle of an order of 7° relative to the longitudinal axis of the snake. As is fully described in U.S. Pat. No. 3,224,024, issued to Hunt, this novel configuration, along with the unique design of the helical grooves or channels formed around the periphery of the rollers, causes the snake to be fed at a rate several times faster than is possible with conventional tools embodying stationary feeding jaws.

OPERATION

With the apparatus of the invention assembled as shown in FIGS. 1, 2 and 3, and with the end of the coiled spring or snake 16 inserted into the pipe to be cleaned, cleanout operations can be commenced. By activating motor 18, snake housing 14 along with snake 16 can be caused to rotate in a clockwise direction. To move the snake engaging means of first means 36 into chucking engagement with the snake, the control rod assembly 88 of control means 77 is moved from the position illustrated by the solid lines of FIG. 4 into the position shown by the phantom lines. This is done by lifting up on sleeve 94 against the urging of spring 96 until the lower end of the sleeve clears opening 93 formed in housing 30. Once the lower end of sleeve 94 clears opening 93, the second biasing means or spring 102, which is coiled as shown in FIG. 3, will urge loading ring 82 forwardly of housing 30 into the position shown in FIG. 5. This, in turn, causes the control rod 90 which is threadably connected to ring 82 to move forwardly of housing 30 within slot 92. Forward movement of ring 82 also causes conically shaped element 78 of interengaging means 76 to move forwardly of housing 30 in operative engagement with the sloping walls 100 of segments 40 of first means 36, thereby camming the segments 40 inwardly against the urging of the first biasing means or springs 70 (FIG. 6). When the components of the drive control mechanism reach the position shown in FIGS. 5 and 6 of the drawings, rollers 46 of the snake engaging means will be urged into gripping engagement with the rotating snake 16 and the entire assembly comprising first means 36 and interengaging means 76 of second means 74 will be caused to rotate on roller bearings 62 and 86 about the longitudinal axis of housing 30. The unit is now in the dwell mode with snake 16 being supported in a chucking relationship by rollers 46.

To move the unit into a feed mode so as to feed the coiled spring or snake axially of itself into the pipe to be cleaned, the stop or feed control means of the invention must be activated. This is accomplished by the operator pushing down on feed control lever 118 so as to cause piston 122 to move into engagement with the support means or supporting rings 42, 54 and 58, as shown in FIG. 7, with sufficient force to stop the rotation of first means 36 and interengaging means 76. When the rotation of these subassemblies is stopped, the rotation of snake 16 will cause rollers 46 to rotate relative to segments 40 about axles 48 in a direction opposite to the direction of rotation of the snake. As previously discussed, due to the novel design of the helical grooves formed about the periphery of the rollers 46,

the snake will be fed forwardly of housing **30** at a rate of speed proportional to the speed of rotation of the snake.

So long as the feed control lever is held down so as to preclude rotation of the chucking assembly or first means **36** and so long as the snake can move forwardly within the pipe without encountering significant impedance to such forward movement, the snake will feed into the pipe at a generally uniform rate of speed. Because of the novel design of the mechanism, the feed control apparatus can accommodate deformations in the snake such as kinks or couplings without endangering either the equipment or the operator. Referring to FIG. **5** and assuming piston **122** is depressed so as to place the device in the feed mode, it can be seen that any kink, coupling or other deformation in the snake encountered by the feed rollers **46** will generate a force vector tending to move the rollers radially outwardly. This force vector, in turn, is transmitted to the sloping inner walls of conically shaped element **78** of interengaging means **76** where it will be translated into a force vector tending to move loading ring **82** axially rearwardly of housing **30** against the urging of the second biasing means or spring **102.** When this force vector reaches sufficient magnitude to overcome the resistance of spring **102,** the entire second means **74** will be moved rearwardly of housing **30.** The control rod assembly **88** will move in a counterclockwise direction, as viewed in FIG. **4,** and the snake engaging means will move toward the configuration shown in FIG. **3.** This separation of the rollers **46** will, of course, permit the deformation in the spring to pass. Once the deformation has passed, the second biasing means or spring **102** will again urge the interengaging means forwardly of the housing, thereby camming the rollers **46** into gripping engagement with the coiled spring and causing the spring to be threaded forwardly relative to the rollers.

The ability of the snake engaging means to automatically move into and out of engagement with the snake against the urging of the second biasing means in the manner just discussed also constitutes an important safety feature of the invention. For example, in the eventuality that the snake encounters a blockage in the pipe which impedes its forward movement, unless the forward speed of the snake can be instantaneously slowed, or in some instances completely stopped, the equipment can be seriously damaged and the operator exposed to risk of significant injury. Because of the novel and unique arrangement of the feed control device of the present invention, however, the rate of feed of the snake in such eventualities is automatically controlled and the possibility of damage to the equipment or injury to the operator is effectively eliminated.

Again referring to FIG. **5,** and assuming the device has been placed into the feed mode by depressing piston **122,** it can be seen that spring **102** imparts an axial force to conically shaped member **78** through ring **82.** This force is translated into a radial force vector causing inward movement of segments **40** and, in turn, causing rollers **46** to move into gripping engagement with snake **16.** When the snake is feeding normally at a rate of on the order of 12 feet per minute, the rollers are held in normal frictional driving engagement with the rotating snake by the urging of spring **102.** However, when the snake encounters an impedance to forward movement, such impedance is instantaneously sensed by the snake engaging means in the form of a force vector opposing forward feed of the snake. Because of the novel design of the helically-grooved rollers, this force vector is translated into a radial force vector tending to move the rollers radially outwardly in opposition to the force exerted by spring **102.** This radial force vector causes the rollers to grip the snake with less force and, therefore, permits slippage between the rollers and the snake, which in turn, results in a decreased rate of feed of the snake proportional to the impedance encountered. If the blockage within the pipe is so severe that the snake cannot work its way past the obstruction and further forward, feed of the snake becomes impossible. The resultant rearwardly directed force vector will simply cause the rollers to automatically move radially outwardly in a repetitive ratcheting-like manner with the helical grooves, in effect, jumping over the coils formed in the spring. In this way the forward feed of the snake is immediately and automatically reduced to zero. The operator can then reverse the motor so that the snake can be safely withdrawn from the pipe by the resultant reversed rotation of the rollers **46.**

A further safeguard is also inherent in the construction of the stop means itself. For example, if torque conditions become extreme, a slippage between the piston **122** and surfaces **54, 58** and **42** will result permitting the assemblage to rotate within the housing thereby reducing the feed rate.

Additionally, the operator can, of course, at any time release the feed lever **118** at any visual sign of extreme torque conditions, thus instantly returning the feed rate to zero and returning the grooved rollers to a grip action on the coiled spring.

If slippage of the rollers relative to the snake is greater than desired, the loading on spring **102** can be increased by means of the loading adjusting mechanism in the manner previously described. Increased loading on the spring will, of course, cause the rollers **46** to be urged against the snake with greater force and the opposing vertical force vector generated by impedance to forward movement of the snake must be of greater magnitude to affect radially outward movement of the rollers and concomitant slippage between the rollers and the snake.

By automatically controlling the feed of the snake in proportion to the impedance encountered by the snake within the pipe, the cleaning efficiency of the tool is significantly enhanced, damage to the snake due to excessive torque buildup within the snake is avoided, and, most importantly, the operator is fully protected from serious injuries which can be caused by the highly dangerous whipping action of broken or overstressed coil spring snakes.

I claim:

1. A plumbing tool for use in cleaning out drains, conduits and the like comprising:

a. an elongated coiled spring plumbers snake,

b. means for rotating said plumbers snake about its longitudinal axis;

c. first means including snake engaging means movable into and out of operable engagement with said plumbers snake for feeding said snake in an axial direction, said first means also including first biasing means for yieldably holding said snake engaging means normally out of engagement with said snake;

d. second means movable into operable engagement with said first means for moving said snake engaging means into engagement with said snake against the urging of said first biasing means; and

e. second biasing means for yieldably urging said second means into operable engagement with said first means, said second biasing means being responsive to forces opposing axial feeding of said snake so that said snake engaging means will automatically move out of engagement with said snake in response to such forces.

2. The plumbing tool as defined in claim 1 in which said snake engaging means is rotatable with respect to said plumbers snake and comprises:

a. a plurality of arcuately spaced supporting segments radially movable toward said plumbers snake against the urging of said first biasing means; and

b. snake driving means rotatably carried by said supporting segments for driving said snake axially of itself upon relative rotation between said snake driving means and said snake.

3. The plumbing tool as defined in claim 2 in which said second means comprises interengaging means rotatable with respect to said plumbers snake and movable into operable engagement with said supporting segments for moving said segments radially toward said snake against the urging of said first biasing means.

4. The plumbing tool as defined in claim 3 in which said snake driving means comprises a plurality of feed rollers rotatably carried by said supporting segments, each said feed roller having peripheral grooves adapted to drivably engage said snake.

5. The plumbing tool as defined in claim 3 in which said first means further includes stop means for stopping the rotation of said snake engaging means with respect to said snake.

6. A plumbing tool of the type used for cleaning drains, conduits and the like and characterized by having a plumbers snake housing in which an elongated plumbers snake can be coiled, said snake housing having an opening for passage of the snake and including means for rotating the housing relative to the feed device, comprising:

a. a housing having an axial passageway adapted to accommodate passage of said snake;

b. first means rotatably carried within said housing for cooperative engagement with said snake, said first means comprising snake engaging means for feeding said snake in an axial direction relative to said housing, said snake engaging means being movable into and out of engagement with said snake and including a first biasing means for yieldably holding said snake engaging means normally out of engagement with said snake;

c. second means for cooperative engagement with said first means comprising interengaging means rotatably carried within said housing and movable into mating engagement with said first means for moving said snake engaging means into operative engagement with said snake against the urging of said first biasing means;

d. second biasing means cooperatively associated with said second means for yieldably urging said interengaging means into engagement with said first means; and

e. said first means further including stop means carried by said housing for stopping the rotation of said first means relative to said housing.

7. The apparatus as defined in claim 6 including control means carried by said housing for moving said interengaging means of said second means out of operative engagement with said first means against the urging of said second biasing means.

8. The apparatus as defined in claim 6 in which said feed means comprises a plurality of feed rollers rotatable relative to said snake and having peripheral grooves adapted to engage said snake so as to urge axial movement thereof relative to said feed rollers.

9. The apparatus as defined in claim 6 in which said feed means comprises:

a. a plurality of arcuately spaced, radially movable segments; and

b. a plurality of snake engaging driving means carried by said segments.

10. The apparatus as defined in claim 9 in which said segments of said feed means in combination form a conically shaped assembly and in which said interengaging means of said second means is in the form of a recessed cone movable axially within said housing and constructed and arranged to mate with said segments in a manner as to urge them radially inwardly against the urging of said first biasing means.

11. A plumbing tool comprising:

a. an elongated plumbers snake;

b. means for rotating said plumbers snake about its longitudinal axis;

c. a housing having an axial passageway adapted to accommodate passage of the snake;

d. first means rotatably carried by said housing for cooperative engagement with the snake, said first means having an axial passageway for reception of the snake and including:

1. a plurality of arcuately spaced, radially movable segments;

2. a plurality of feed rollers rotatably carried by said segments proximate the axial passageway, said feed rollers being constructed and arranged as to be movable into releasable engagement with the snake upon inwardly radial movement of said segments and each having peripheral grooves adapted to drivably engage the snake; and

3. first biasing means for yieldably resisting inward radial movement of said segments;

e. second means cooperatively associated with said first means for operating said first means comprising:

1. interengaging means rotatably carried within said housing and movable into operable engagement with said segments of said first means for moving said segments radially inward against the urging of said biasing means;

2. second biasing means for urging said interengaging means into engagement with said segments; and

3. control means for moving said interengaging means out of operable engagement with said segments; and

f. stop means carried by said housing for preventing rotation of said first means within said housing.

12. A feed control apparatus for use with plumbing tools of the type having an elongated coiled spring wire

or plumbers snake and means for rotating the snake about its longitudinal axis, comprising:

a. snake engaging means movable into and out of driving engagement with the snake for feeding the snake axially of itself; and

b. means operably coupled with said snake engaging means for moving said snake engaging means into driving engagement with the snake, including biasing means for yieldably urging said snake engaging means into driving engagement with the snake, said biasing means being responsive to forces opposing axial feeding of the snake so that said snake engaging means will automatically move out of driving engagement with the snake in response to such forces.

13. The feed control apparatus as defined in claim 12 in which said snake engaging means comprises:

a. a plurality of arcuately spaced segments radially movable toward and away from the snake and rotatable with respect thereto;

b. a plurality of feed rollers rotatably carried by said segments each said roller having snake engaging surfaces adapted to operably engage the snake so as to urge axial movement thereof relative to said feed rollers; and

c. first biasing means operably associated with said segments for yieldably resisting radial movement thereof toward the snake.

14. The feed control apparatus as defined in claim 12 in which said means for moving said snake engaging means into driving engagement with the snake includes interengaging means rotatable relative to the snake and movable into operable engagement with said segments for moving said segments radially toward the snake against the urging of said first biasing means.

15. The feed control apparatus as defined in claim 14 in which said snake engaging means includes stop means for stopping the rotation of said segments with respect to the snake.

16. The feed control apparatus as defined in claim 14 including adjustment means for adjusting said biasing means so as to vary the force with which said biasing means urges said engaging means into driving engagement with said snake.

* * * * *

United States Patent [19]

Hukuba et al.

[11] **3,958,297**

[45] **May 25, 1976**

[54] **SUCTION CLEANER**

[75] Inventors: **Hiroshi Hukuba**, Nagareyama; **Iwao Ikegami**, Ichikawa; **Teruaki Yasuda**, Tokorozawa, all of Japan

[73] Assignee: **Kabushiki Kaisha Hukuba Future Research**, Nagareyama, Japan

[22] Filed: **Apr. 17, 1974**

[21] Appl. No.: **461,783**

[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **15/315;** 15/323; 15/377; 254/175.5

[51] **Int. Cl.²** **A47L 5/38**

[58] **Field of Search** 15/315, 323, 377; 226/118, 181; 254/175.5

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Primary Examiner—Robert W. Jenkins
Assistant Examiner—C. K. Moore
Attorney, Agent, or Firm—Woodhams, Blanchard and Flynn

[57] **ABSTRACT**

A suction cleaner, wherein the interior of a container thereof is divided into two chambers, namely, the first chamber and the second chamber, by a partition, and the first chamber accommodates a suction fan, a filter member and a dust-receiving box installed therein while the second chamber randomly stores a suction hose, the rear end of said hose being rotatably supported within an opening provided in said partition while the front end of said hose projects out of an opening provided on one side of said container; a device for the paying-out and hauling-in of the hose is installed adjacent the inside of said opening provided on the container; lead wires are provided for the hose along the whole length thereof, the front end of said lead wires being connected with a switch mounted on the hose while the rear end of the same being connected with a ring contact provided on the hose; said movable contact is devised to be in touch with a fixed contact provided on the partition; and said fixed contact is connected with the controlling circuits of the driving power sources.

5 Claims, 3 Drawing Figures

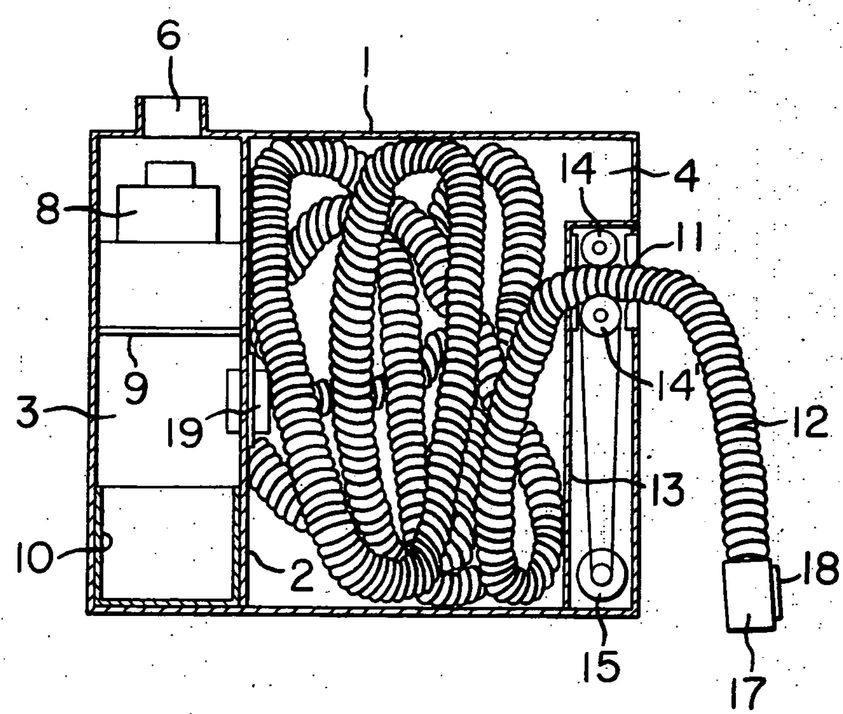

FIG. 1

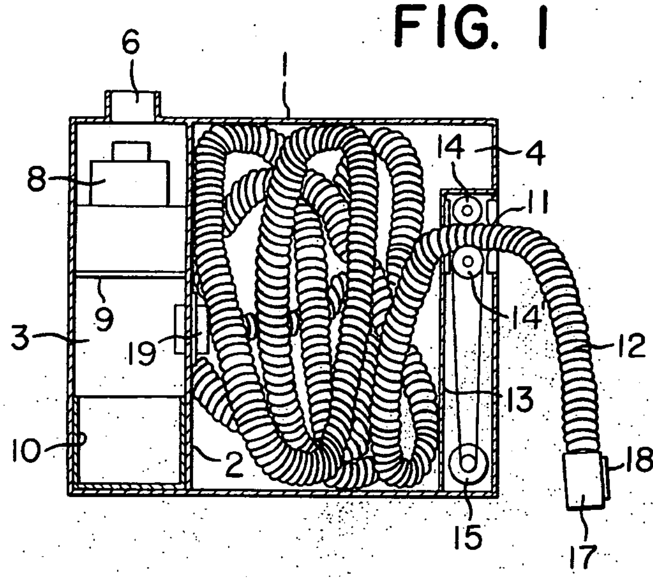
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FIG. 2

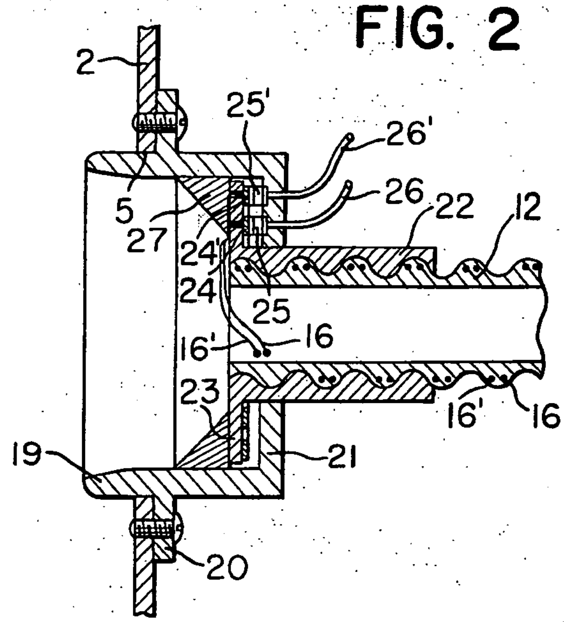
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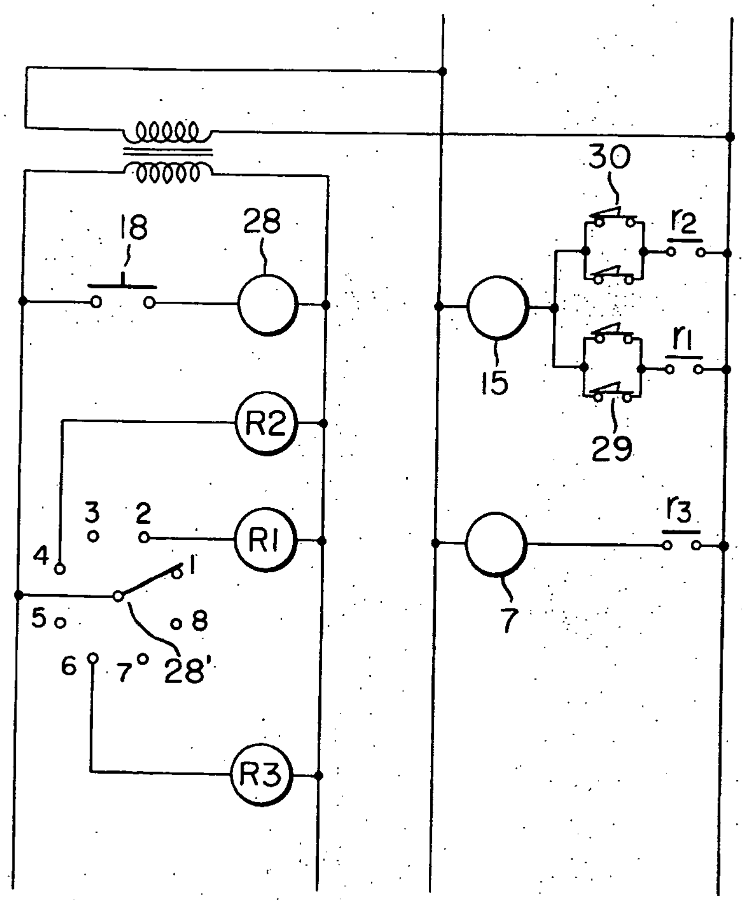
FIG. 3



SUCTION CLEANER

BACKGROUND OF THE INVENTION

The present invention relates to a suction cleaner. One well-known suction cleaner has a construction wherein the interior of a container is divided into two chambers by a partition; one chamber accommodating a suction fan, filter member and a dust-receiving box installed therein and the other chamber accommodating a rotating drum to wind a suction hose therearound it; the rear end of said hose is fixed on said partition so as to open therethrough while the front end of the hose is allowed to stick out of the chamber; and a pair of rotating rollers driven by a motor are provided for the purpose of holding said hose therebetween as well as paying it out from or hauling it into the container by virtue of their rotation.

However, a suction cleaner of this type has a drawback that not only its construction is intricate because of the provision of said rotating drum but also it is difficult to smoothly wind the hose around said rotating drum.

Moreover, a suction cleaner of this type has another drawback that, inasmuch as the rear end of the hose is fixed on the partition, due to the twisting force arising from the hauling of the hose into the container, the hose tends to get intertwined and, in an extreme case, it is tied into a bundle, rendering it very difficult or impossible to pay it out of the chamber.

One object of the present invention is to overcome the foregoing drawbacks of the conventional suction cleaners and to provide an improved suction cleaner which can accommodate the hose by letting it fill the chamber therefor at liberty without resorting to the provision of a rotating drum for winding it and facilitate the hauling-in of the hose despite the simple construction thereof.

Another object of the present invention is to provide an improved suction cleaner which overcomes the drawbacks of the conventional suction cleaners and is so devised that the rear end of the hose is rotatably fixed to the partition so as to open therethrough and the twisting force arising from the hauling of the hose into the container is relieved by turning the rear end of the hose on the partition along the direction of said twisting force, whereby the hose is prevented from getting intertwined within the container and the paying-out of the hose can be performed smoothly.

A further object of the present invention is to provide a suction cleaner, wherein the lead wires are provided for the hose along the whole length thereof, the front end of said lead wire being connected with a switch mounted on the hose and the rear end of the same being connected with a movable contact provided on the hose, said movable contact being devised to be in contact with a fixed contact provided on the partition, said fixed contact being connected with the controlling circuits of a motor for driving the suction fan and a motor for driving the member for paying out and hauling in the hose, and these motors being driven through remote control by means of a switch.

The present invention will be explained more particularly with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings,

FIG. 1 is a front view of the vertical section of a part of an apparatus embodying the present invention;

FIG. 2 is a vertical section — on an enlarged scale — of the essential part of the same apparatus as shown in FIG. 1; and,

FIG. 3 is a diagrammatic representation of the controlling circuits within the apparatus shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, 1 denotes a container, whose interior is divided into a first chamber 3 and a second chamber 4 by a partition 2, said partition 2 being provided with the opening 5 through which said two chambers are interconnected.

The top of the chamber 3 is provided with the exhaust hole 6, and below said exhaust hole 6 there is installed the suction fan 8 with the motor 7. The inlet port side of this suction fan 8 is provided with the filter 9, and below said filter 9, there is placed the dust-receiving box 10 which can be freely taken in and out.

The side wall of the chamber 4 is provided with the opening 11 through which the hose 12 being accommodated in said chamber 4 can be paid out or hauled in. Adjacent the inside of the opening 11, there is installed the supporting frame 13, and on this supporting frame 13 are pivoted a pair of rotating rollers 14 and 14' which are disposed above and below the hose 12 so as to hold it therebetween and are devised to rotate in opposite directions. These rollers 14 and 14' are interlocked and one roller 14' is so devised as to be selectively rotated both clockwise and anticlockwise by means of the reversible motor 15 installed in the chamber 4.

The hose 12 consists of a couple of helical lead wire 16 and 16' disposed parallel to each other and having their exterior surrounded with a flexible covering film, the front end of said hose 12 being provided with the coupling 17 for the purpose of connecting with a suction pipe not shown in the drawing while the rear end of the same being rotatably connected with the partition 2 at the opening 5 thereon. The coupling 17 is equipped with the normally open switch 18 which is connected with the front ends of the lead wires 16 and 16'.

FIG. 2 is illustrative of the state of connection between the partition 2 and the hose 12. That is, a cylindrical portion of a cylindrical receiving member 19 is inserted in the opening 5 and is fixed to the partition 2 by means of the ring flange 20 provided on the outer surface of said cylindrical portion. In the opening provided on the end wall 21 of the cylindrical receiving member 19, there is rotatably inserted the cylindrical portion of the cylindrical supporting member 22, and the end of said cylindrical portion of the supporting member 22 within the receiving member 19 is provided with the ring seat 23, and on the surface of one side of said ring seat 23 confronting the inner side of the end wall 21 there are fixed the ring contact plates 24 and 24'. Meanwhile, the inner surface of the supporting member 22 is provided with a female screw profile of the same pitch as that of the helix of the hose 12, so that the rear end of the hose 12 can be screwed in the supporting member 22, and the rear ends of the lead wires 16 and 16' are connected with the ring contact plates 24 and 24' respectively. And, in order to prevent the supporting member 22 from moving toward the chamber 3, the stop ring 27 is provided on the back of the ring seat 23. On the inside of the end wall 21, there are provided the resilient contacts 25 and 25' disposed to confront the contact plates 24 and 24' respectively, and the lead wires 26 and 26' are connected with said

contact plates 25 and 25' respectively.

FIG. 3 shows a typical controlling circuit to be applied to the present invention. In the drawing, 28 denotes a stepping relay coil and 28' denotes the stepping relay switch which is actuated through the excitation of the step coil 28, both of which are commonly known. R_1 and R_2 denote the relay coils which actuate the relay switch r_1 for the normal rotation and the relay switch r_2 for the reverse rotation of the motor 15, respectively, and R_3 denotes the relay coil for actuating the relay switch r_3 for the motor 7 to drive the fan 8. 29 and 30 denote microswitches, and they are connected with the relay switches r_1 and r_2, respectively. These microswitches 29 and 30 are so devised that they are normally closed and are to open only when they are engaged with a push ring (not shown in the drawing) provided on the hose 12 for controlling the length of hose paid out or hauled in respectively. The microswitches 29 and 30 and the actuation thereof by push rings on the hose is disclosed in detail in our copending application Ser. No. 456,461, filed Apr. 1, 1974.

Hereunder will be explained how to operate the above described apparatus.

The hose 12 is usually accommodated in the chamber 4 of the container 1 as shown in FIG. 1. In order to pay out the thus accommodated hose 12 to the extent of a desired length, the step coil 28 and the stepping relay 28' are actuated by closing the switch 18. Closing of switch 18 energizes coil 28, which then causes the switch 28' to automatically advance one step so as to engage contact No. 2. The relay coil R_1 is thus energized and closes the relay switch r_1, the motor 15 starts rotating in the normal direction, and the rotating rollers 14 and 14' rotate in the normal direction, respectively, whereby the hose held between said rollers is paid out from the container 1. When a desired length of the hose has been paid out, either the switch 18 is opened to deenergize coil R_1 so that switch R_1 opens, or the push ring (not shown in the drawing) provided on the hose 12 engages and opens the microswitch 29, whereby the rotation of the motor 15 is discontinued. When switch 18 is opened, coil 28 is deenergized so that switch 28' is automatically advanced one step so as to engage contact No. 3.

By again closing switch 18, coil 28 is energized and switch 28' automatically advances one step to contact No. 4. Coil R_3 is thus energized and relay switch r_3 is closed to rotate the motor 7, whereby the suction fan 8 is actuated to suck in the dust-containing air current through the suction pipe (not shown in the drawing) fixed to the coupling 17 equipped on the front end of the hose 12 and lead it into the chamber 3 through the receiving member 19. The dust is filtered by the filter 9 to fall into the dust-receiving box 10, and the purified air after the filtration is discharged to the outside through the exhaust hole 6. The dust accumulated in the dust-receiving box 10 is disposed of upon removing the box from the container 1.

When the cleaning of a desired place has been completed in this way, the switch 18 is again operated, being first opened to deenergize coil 28, whereby switch 28' advances to contact No. 5. Switch 18 is then closed to energize coil 28 and advance switch 28' to contact No. 6. Relay coil R_2 is thus energized so that switch r_2 is closed to rotate the motor 15 in the reverse direction, and by virtue of the reversed rotation of the rotating rollers 14 and 14', the hose 12 is hauled into the container 1. When the hose 12 has been accommodated in the container 1, the push ring (not shown in the drawing) provided on the hose 12 engages and opens the microswitch 30 and discontinues the rotation of the motor 15.

Although a particular preferred embodiment of the present invention has been disclosed hereinabove for the purpose of illustration, it will be understood that variations and modifications thereof which lie within the scope of the invention as defined by the appended claims are fully contemplated.

What is claimed is:

1. In a suction cleaner, the combination comprising:

housing means defining an interior compartment therein, said housing means including and interior partition dividing said compartment into first and second interior chambers, said interior partition having a first opening therein providing communication between said first and second chambers, and said housing means having a second opening formed therein and commiunicating with said second chamber;

suction means, filter means and dust receiving means disposed in said first chamber;

said second chamber being free of obstructions;

an elongated flexible suction hose stored within said second chamber, said suction hose having the front end portion thereof projecting outwardly through said second opening, the rear end portion of said hose being associated with said first opening so that said hose communicates with said first chamber, and the intermediate portion of said hose as disposed between the front and rear end portions being stored within said second chamber in a random and non-coiled manner;

connecting means coacting between said interior partition and the rear end portion of said hose for axially anchoring the rear end portion of said hose to said interior partition, said connecting means including rotatable coupling means for permitting the rear end portion of said hose to rotate about its longitudinal axis relative to said interior partition so as to relieve twisting of the hose caused by said random and non-coiled manner of storage; and

dirve means for causing said hose to be paid out or hauled in through said second opening, said drive means including a drive motor drivingly connected to a first reversible rotatable roller rotatably supported adjacent said second opening and positioned for engagement with said hose for causing said hose to be paid out or hauled in through said second opening depending upon the direction of rotation of said roller, said drive means including a second reversible rotatable roller disposed opposite said first roller so that the hose is held between said rollers.

2. In a suction cleaner according to claim 1 wherein said drive means includes a second roller disposed opposite the first-mentioned roller so that the hose is held between said rollers.

3. In a suction cleaner according to claim 2 wherein said motor is reversible for controlling the rotational direction of said first-mentioned roller.

4. In a suction cleaner according to claim 1 wherein said hose has electrical conductor means mounted thereon and extending along the length thereof, switch means mounted on said hose adjacent the front end portion thereof and connected to said electrical conductor means, said rotary coupling means including an

annular portion fixed to the rear end portion of said hose and a support portion fixed to said interior partition and rotatably containing said annular portion, first electrical contact means mounted on said annular portion and interconnected to said conductor means, and second electrical contact means mounted on said support portion and disposed for engagement with said first contact means, one of said first and second contact means including an annular contact ring concentric with said hose so as to permit the first and second contact means to remain electrically connected irrespective of rotation of the rear end portion of the hose.

5. In a suction cleaner, the combination comprising:

housing means defining a compartment therein, said housing means including an interior partition dividing said compartment into first and second chambers, said interior partition having a first opening therein providing communication between said first and second chambers, and said housing means having a second opening formed therein and communicating with said second chamber;

suction means, filter means and dust receiving means disposed in said first chamber;

an elongated flexible suction hose stored within said second chamber in a random manner, said suction hose having the front end portion thereof projecting outwardly through said second opening, the rear end portion of said hose being associated with said first opening so that said hose communicates with said first chamber;

connecting means coacting between said inerior partition and the rear end portion of said hose for axially anchoring the rear end portion of said hose to said interior partition;

drive means for causing said hose to be paid out or hauled in through said second opening, said drive means including a drive motor drivingly connected to a reversible rotatable roller rotatably supported adjacent said second opening and positioned for engagement with said hose for causing said hose to be paid out or hauled in through said second opening depending upon the direction of rotation of said roller; and

first and second electrical lead wires provided on the hose along the length thereof, switch means mounted on the hose adjacent the front end portion thereof and connected to the front ends of said first and second lead wires, the rear ends of said lead wires being correspondingly connected to first and second ones of a first pair of electrical contacts which are mounted on said hose adjacent the rear end portion thereof, the rear end portion of said hose being rotatable relative to said interior partition so that said first pair of contacts are movable relative to said interior partition, a second pair of contacts provided on said interior partition and disposed for continuous engagement with said first pair of contacts, and circuitry means electrically connecting said second pair of contacts to said drive motor and said suction means.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3 958 297

DATED : May 25, 1976

INVENTOR(S) : Hiroshi Hukuba et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 14; change "and interior" to ---an interior---.

Column 4, line 20; change "commiunicating" to ---communicating---.

Column 4, line 44; change "dirve means" to ---drive means---.

Column 4, line 56; change "claim 1" to ---claim 5---.

Column 6, line 1; change "inerior" to ---interior---.

Column 6, lines 17 and 18; change "of said first and second lead wires" to ---of said lead wires---.

Column 6, lines 18 and 19; change "of said lead wires" to ---of said first and second lead wires---.

Figure 3 should appear as shown on the attached page.

Signed and Sealed this

Eighth **Day of** *November 1977*

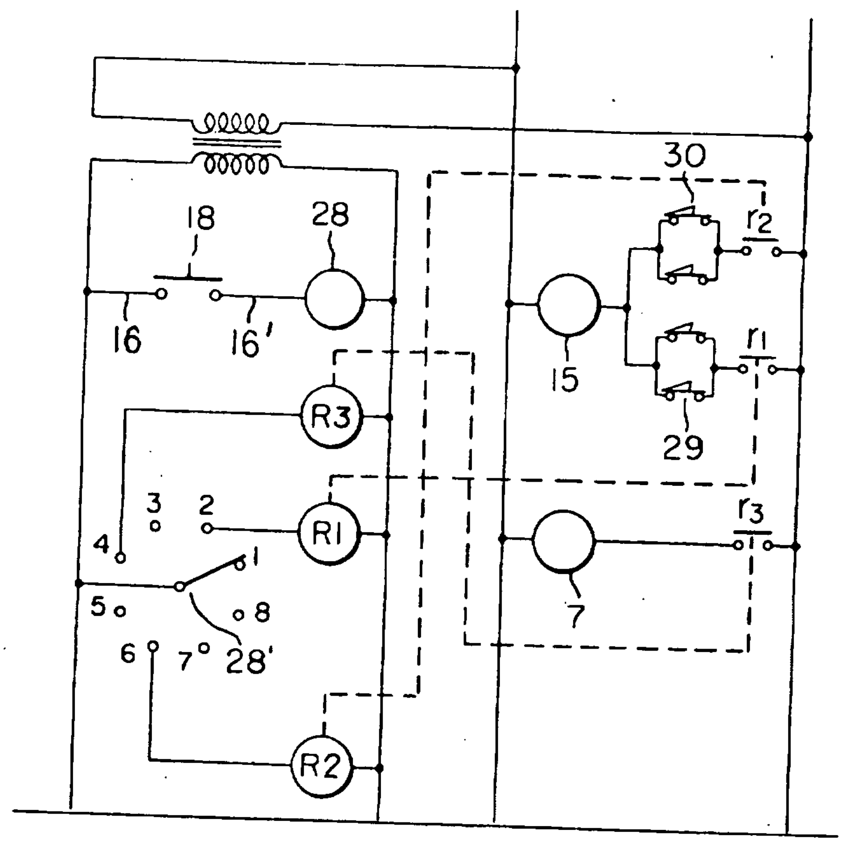
[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

LUTRELLE F. PARKER
Acting Commissioner of Patents and Trademarks

FIG. 3



United States Patent [19]

Mercer

[11] **4,133,347**

[45] **Jan. 9, 1979**

[54] **WASTE EVACUATION ATTACHMENT FOR RECREATIONAL VEHICLES**

[76] Inventor: **Albert Mercer, P.O. Box 446, Franklin, Mass. 02038**

[21] Appl. No.: **847,122**

[22] Filed: **Oct. 31, 1977**

[51] **Int. Cl.**[2] **F16K 27/12;** F16L 3/00

[52] **U.S. Cl.** **137/344;** 137/355.16; 285/62; 285/299; 285/402; 285/423; 285/DIG. 2

[58] **Field of Search** .... 137/344, 355.16; 285/62, 121, 299, 401, 402, 423, 376, 302, 300, 301, DIG. 2; 138/106; 141/383-386, , 382, 388, 379; 222/538, 530, 567, 543

[56] **References Cited**

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2,915,081	12/1959	Warren	285/298 X
3,496,959	2/1970	Wolfe et al.	137/344
3,712,331	1/1973	Otto	137/355.16
3,730,228	5/1973	Gibbs	285/302 X
3,811,462	5/1974	Feliz	137/344

FOREIGN PATENT DOCUMENTS

2154814	4/1973	France	285/299

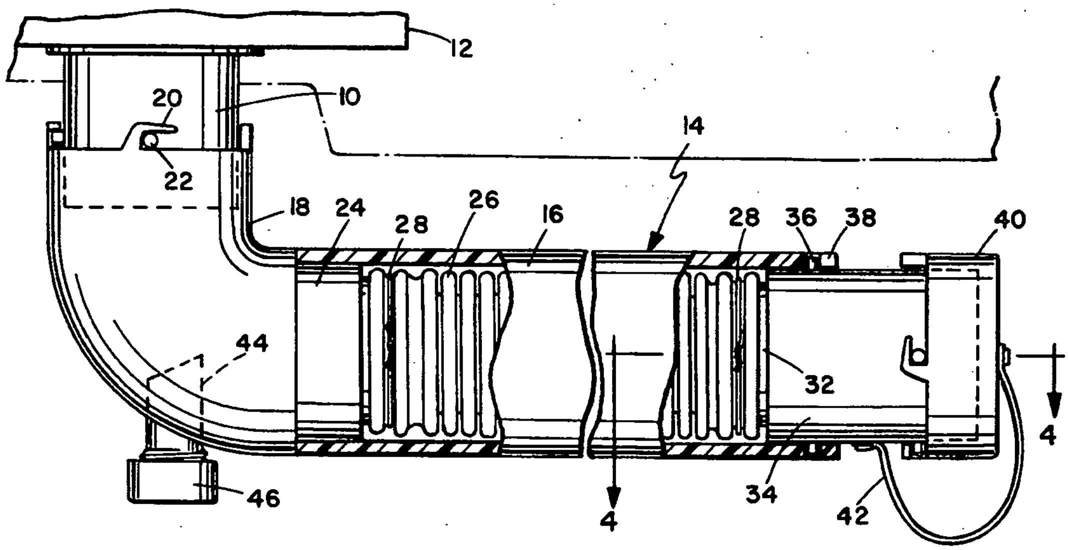
Primary Examiner—Dave W. Arola

Attorney, Agent, or Firm—Ralph S. Branscomb

[57] **ABSTRACT**

A waste evacuation attachment for a recreational vehicle comprises a rigid cylindrical housing readily mountable to the existing fittings of a sewage discharge outlet of the recreational vehicle, there being a telescoping hose contained within the housing and having a fitting on the extendable end to adapt the hose to waste receiving receptacles, the assembly eliminating the difficulties inherent in conventional recreational vehicles which require the attachment and removal of a separate hose unit whenever the vehicle hooks up at an overnight site.

6 Claims, 7 Drawing Figures



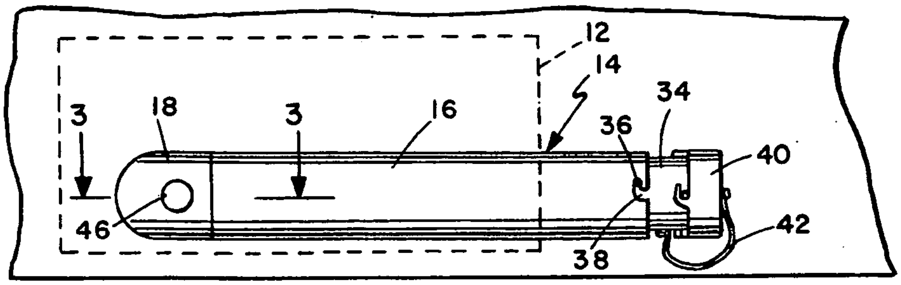


Fig. 1

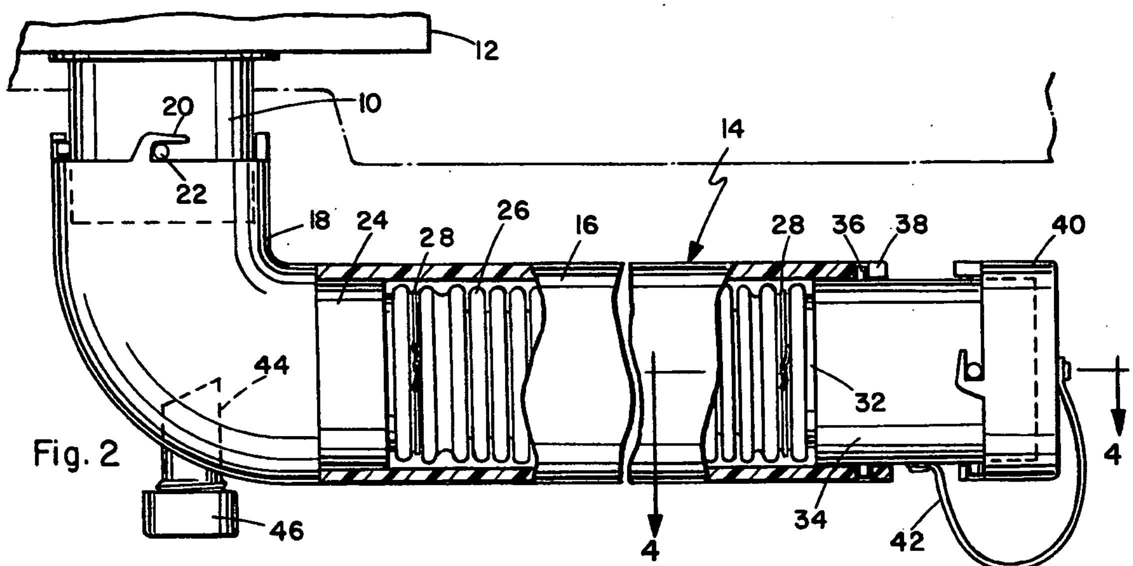


Fig. 2

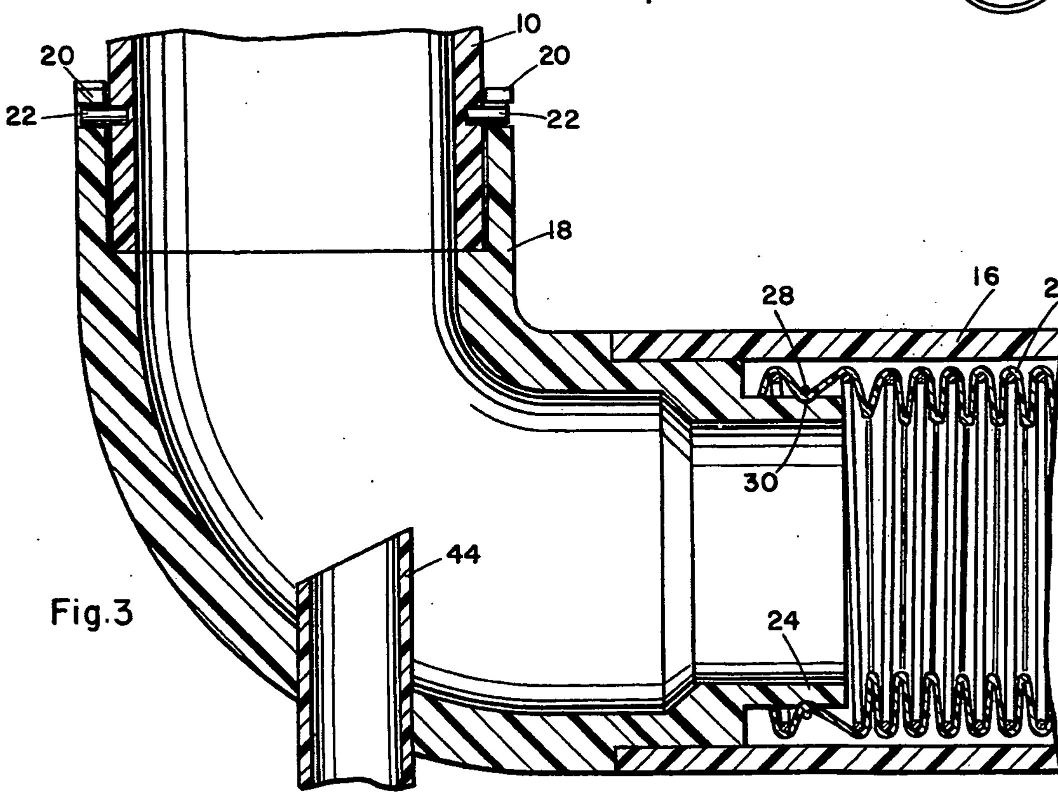


Fig.3

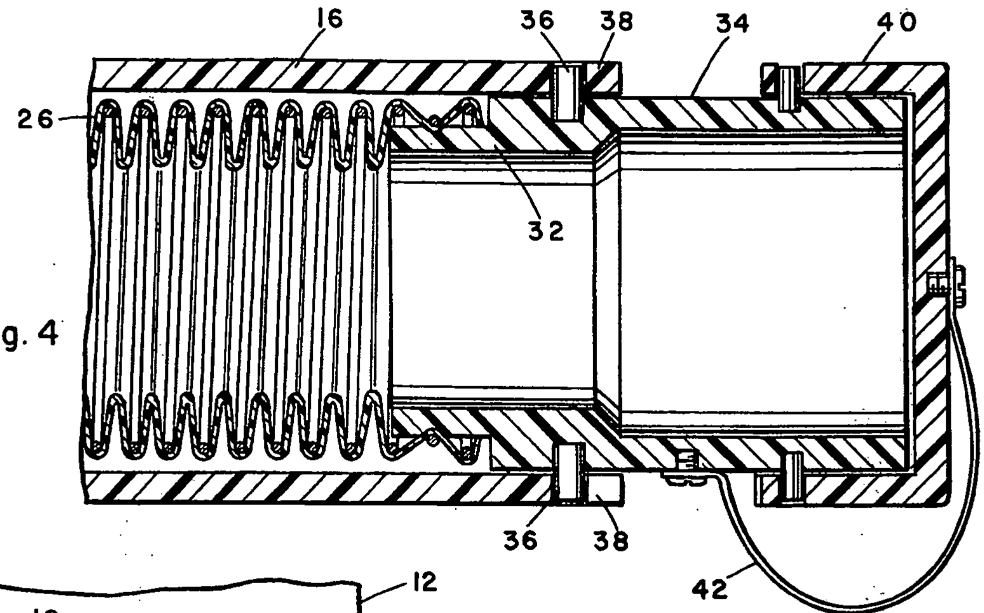


Fig. 4

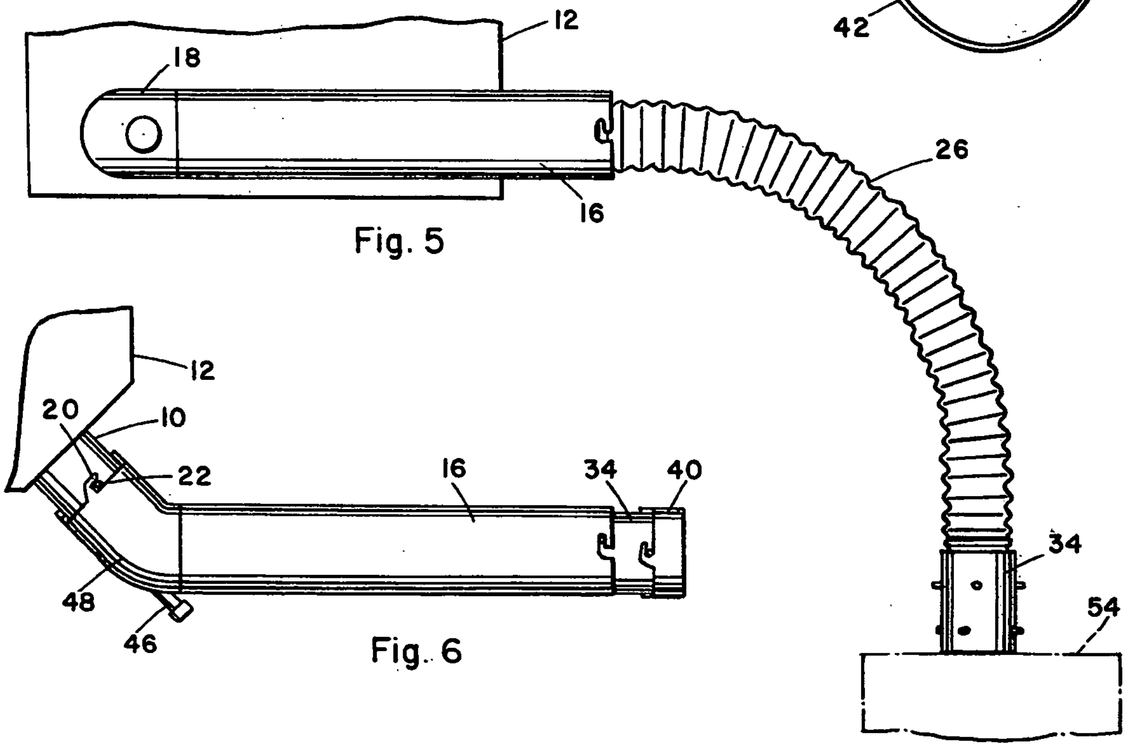


Fig. 5

Fig. 6

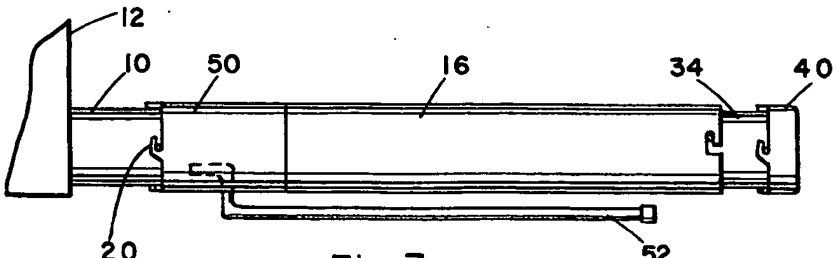


Fig. 7

WASTE EVACUATION ATTACHMENT FOR RECREATIONAL VEHICLES

BACKGROUND OF THE INVENTION

Conventional recreational vehicles having self-contained bathrooms and sewage processing systems uniformly utilize the same means of conducting waste to storage tanks or processing systems which are used in RV parks and the like. These vehicles have an externally accessible cabinet which houses a length of hose which is manually connected to a hose fitting on an outlet stub pipe of the recreational vehicle, the other end being extended to the RV park receptacle fitting. This is at best somewhat clumsy, and it is necessary to handle the hose and flush out the waste when the vehicle is preparing to move on.

There is a need therefore for a simple, ad-on unit which is readily connectable to existing recreational vehicles to simplify this procedure by not requiring the attachment and cleaning of a separate hose assembly. Although units have been devised for simplifying this procedure as is evidence by U.S. Pat. Nos. 3,712,331 and 3,811,462, these units are by and large complicated and require special mounting procedures.

SUMMARY OF THE INVENTION

The present invention is a simple ad-on unit which connects directly to the outlet stub pipe of a recreational vehicle and requires no special mounting procedure whatsoever. The unit comprises a rigid outer cylindrical housing having one end adapted to connect to the existing stub pipe fitting of a recreational vehicle. Contained within the housing is an axially compressible and expandable accordian hose connected at one end to the end of the housing connected to the recreational vehicle, the other end being extendable outside the housing and being connected to an end sleeve having a removable cap thereon, the end sleeve having connections to mount same within the rigid cylindrical housing.

The unit can be installed on vehicles at the point of manufacture with no difficulty, but in the embodiment described they are ideally adapted to be retrofitted on existing recreational vehicles, taking advantage of the mounting fittings which are currently used to attach existing hoses to the stub pipe to convey the sewage to the fitting at the park site.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of the unit attached to a holding tank;

FIG. 2 is an enlarged top plan view of the unit with portions cut away;

FIG. 3 is an enlarged sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is an enlarged sectional view taken on line 4—4 of FIG. 2;

FIG. 5 is a view similar to FIG. 1, but with the hose extended;

FIG. 6 illustrates an alternative connection to a holding tank; and

FIG. 7 illustrates a further type of connection to a holding tank.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The unit is shown in its principal embodiment in FIG. 2 wherein it is attached to a stub pipe sewage outlet **10** of a recreational vehicle, a part of which is shown at **12**. The assembly is indicated at **14** and comprises a central cylinder **16** and a mounting end piece **18** by which the unit is attached to the recreational vehicle.

This attachment is accomplished by means of hooking members **20** which take advantage of existing pegs **22** currently utilized to attach the sewage hose to the recreational vehicle outlet. As is easily visualized these hooks and pegs, which come in sets of four, are connected by inserting the end piece **18** over the stub pipe and twisting a few degrees to the right. The hooks are so arranged that when the connection is made as in FIG. 2, the housing is horizontally extended as shown in FIG. 1.

In side these cylindrical portions **16** of the unit is a collar **24** which is integral with the end piece. This collar could be molded integrally with the end piece, or provided as a separate cylinder and glued or welded in place. An accordian hose **26** is slipped over the collar **24** and attached thereto by a wire **28** which is simply twisted to engage the hose on the end piece. The collar has an annular groove **30** which facilitates the positive engagement thereon of the accordian hose.

Although other means obviously could be used to attach the hose, it is important that inasmuch as the hose is the weakest link in the assembly and represents the part most likely to break or deteriorate over a period of time, it should be easily removable and replaceable so that the entire unit need not be replaced when the hose breaks down.

The other end of the accordian hose is connected in the same manner as the first end to a collar **32** on a cylindrical end piece or sleeve **34**. This sleeve is provided with pegs **36** by which the sleeve is connected to hooks **38** on the outer end of cylindrical portion of the assembly.

At the end of the sleeve **34** is an end cap **40** connected to the sleeve by a line or chain **42** and mounted to the sleeve with the same hook-and-peg means used for other purposes.

It is advantageous from a point of view of utility that the end sleeve **34** can be dislodged from the cylindrical housing while the cap is still in place. In use, the accordian hose can be extended all the way to the necessary receptacle fitting while the cap is on, and then the cap is removed at the last instant so the chance of sewage spilling from the end of the hose is minimized.

A nozzle **44** is injected into the assembly and glued to the connecting end piece **18**. This nozzle has a hose fitting **46** and is utilized for flushing the hose and the pipes within the recreational vehicle prior to storing the hose. This nozzle allows the entire waste elimination system to be flushed from outside, instead of through the toilet which is currently necessary.

As mentioned, the unit is ideal for attachment to an existing stub pipe. A great many recreational vehicles have a stub pipe that exits the side of the vehicle and can best utilize an evacuation assembly of the type shown in FIG. 2 which is mounted as is shown in FIGS. 1 and 2 to extend alongside the vehicle, occupying as little room as is possible.

However, some vehicles have stub pipes that extend at slightly different angles and are positioned somewhat

differently, and for these other types of vehicles modifications of the unit may be easily made by replacing the end piece **18**, which has a right angle bend, by a diagonal fitting such as the member **48** in FIG. **6**, or a straight fitting shown in FIG. **7**. An extended nozzle connector pipe **52** is shown in FIG. **7** which is necessitated by the modified design. The stub pipe in the illustration of FIG. **7** would ordinarily be underneath the vehicle, and the evacuation assembly would extend from this pipe to the perimeter of the vehicle where the accordian hose is easily accessible.

FIG. **5** illustrates the unit in use wherein the accordian hose is extended to a recreational vehicle park waste receptacle fitting **54**.

The unit as described and claimed herein is economical to manufacture, utilizing off-the-shelf structures for the most part so that no molds are required in the manufacture. It is also a great advantage of the unit that it is so easily retrofitted on any recreational vehicle, as well as being very easily adapted to installation at the point of manufacture or permanent installation by the user on a previously manufactured unit simply by applying glue to the contacting areas, to reinforce the hook and peg connectors. The unit greatly simplifies the previously tedious procedure of having to connect, flush, and disconnect the separate hose length currently being used in recreational vehicles, and yet is not rendered impractical by expense, complexity, or inability to easily retrofit the unit onto RV's of conventional manufacture without requiring structural modification of the vehicle.

I claim:

1. A waste evacuation attachment for a recreational vehicle having a stub pipe waste outlet, said attachment comprising:
   - (a) a rigid cylindrical housing having means to connect one end thereof rigidly to said stub pipe in communication therewith, whereby said housing when so connected defines an integral, immobile extension of said stub pipe;
   - (b) an axially expandable hose mounted in said housing and having a fixed end connected to said one end of said housing and having a free end extendable externally of said housing;
   - (c) Said hose being of length when expanded which is large compared to the length of said housing to permit the free end of said hose to reach a stationary sewage receiving tank, and the compressed length of said hose being such that said hose is completely contained in said housing when compressed;
   - (d) an end piece element mounted on the free end of said hose and being adapted to connect to the inlet of a stationary sewage receiving tank to define a continuous waste flow passageway from said waste containment facility through said housing and hose into said stationary sewage receiving tank;
   - (e) a cap element and means to mount same in sealed relation to said end piece element when said attachment is not in use; and
   - (f) said and piece element having means to engage same to said housing when the attachment is not in use to define a compact, self-contained sealed unit completely containing said hose.

2. Structure according to claim **1** and including an injection nozzle with a hose attachment fitting mounted in said housing near said one end thereof to permit the attachment and flushing of said attachment with a garden hose.

3. Structure according to claim **1** wherein said housing defines an internal collar of diameter less than said housing, and said hose is removably connected to said collar.

4. Structure according to claim **3** wherein said hose is mounted over said collar in said housing and connected to said collar by means of a twist wire.

5. Structure according to claim **4** wherein the other end of said hose is removably mounted by means of a twist wire to said end piece element.

6. In a recreational vehicle having a waste containment facility, a self-contained waste discharge system for delivering waste to a stationary sewage receiving tank comprising:
   - (a) a rigid housing mounted on said vehicle and having one end thereof communicating with said discharge system and the other end being open;
   - (b) an axially expandable hose having a fixed end mounted internally in said housing and having a free end extendable externally of said housing through the open end thereof;
   - (c) said hose being of length when expanded which is large compared to the length of said housing to permit the free end of said hose to reach a stationary sewage receiving tank, and the compressed length of said hose being such that said hose is completely contained in said housing when compressed;
   - (d) an end piece element mounted on the free end of said hose and being adapted to connect to the inlet of a stationary sewage receiving tank to define a continuous waste flow passageway from said waste containment facility through said housing and hose into said stationary sewage receiving tank;
   - (e) a cap element and means to mount same in sealed relation to said end piece element when said waste discharge system is not in use; and
   - (f) said and piece element having means to mount same to the free end of said housing to completely contain said hose and define a self-contained, sealed unit.

* * * * *

United States Patent [19]

Larkin

[11] **4,180,102**

[45] **Dec. 25, 1979**

[54] **SEWER CONNECTOR**

[76] Inventor: **Derek J. Larkin**, 1541 Morene Way, Modesto, Calif. 95355

[21] Appl. No.: **970,868**

[22] Filed: **Dec. 14, 1978**

[51] Int. Cl.[2] **B65D 59/04**

[52] U.S. Cl. **138/106**; 138/107; 138/110; 138/121; 206/446

[58] Field of Search 138/106, 110, 107, 121, 138/122, 109; 206/446; 285/373, 419; 248/80

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,700,988	2/1955	Smisko	138/110
2,836,200	5/1958	Webbe	138/110
3,621,994	11/1971	Brown	206/446
3,924,661	12/1975	Bornhoffer	138/110
4,103,943	8/1978	Curtin	285/419
4,109,944	8/1978	Curtin	285/373

Primary Examiner—Lenard A. Footland
Attorney, Agent, or Firm—Clarence A. O'Brien; Harvey B. Jacobson

[57] **ABSTRACT**

The sewer connector comprises an axially compressible hose and a storage container for maintaining the hose or any portion thereof in the compressed state. The container consists of a pair of semi-cylindrical housing portions having soft foam rubber strips which are connected to the inner periphery of the axial ends of each housing section. Slip rings are also provided for maintaining the two housing sections in radial opposition about the flexible hose thereby forming a cylindrical housing with the rubber strips holding the flexible hose in its compressed state.

7 Claims, 3 Drawing Figures

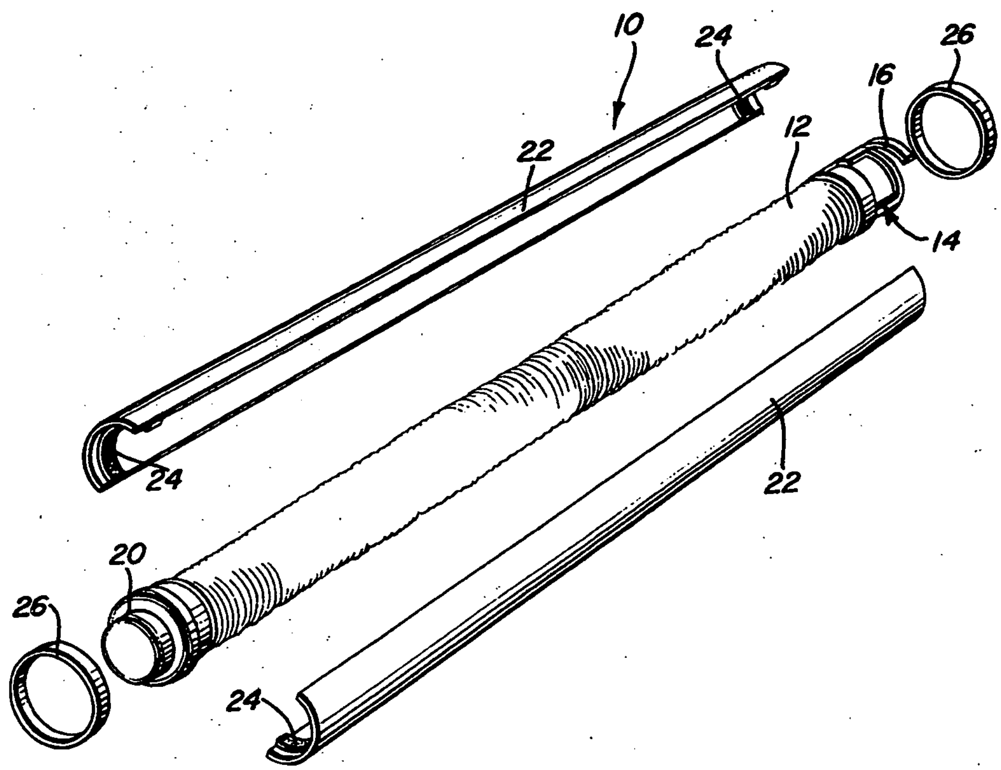


FIG. 1

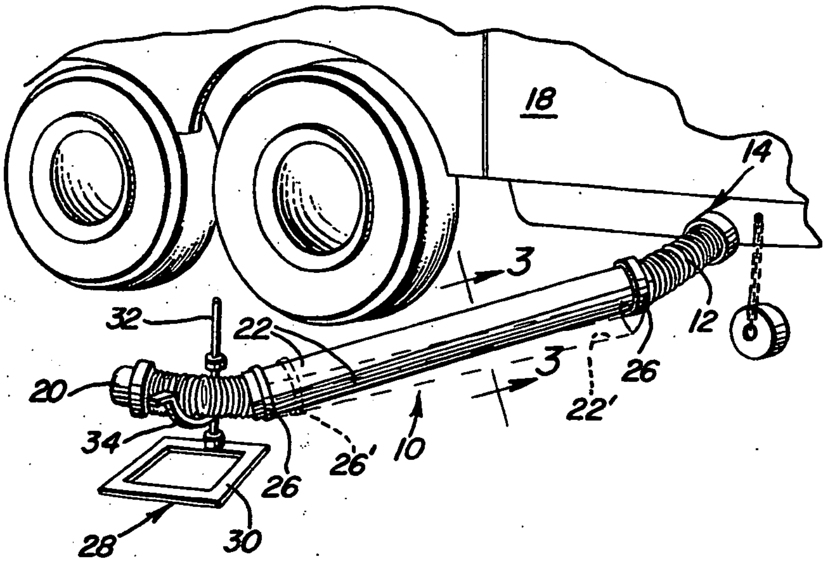


FIG. 2

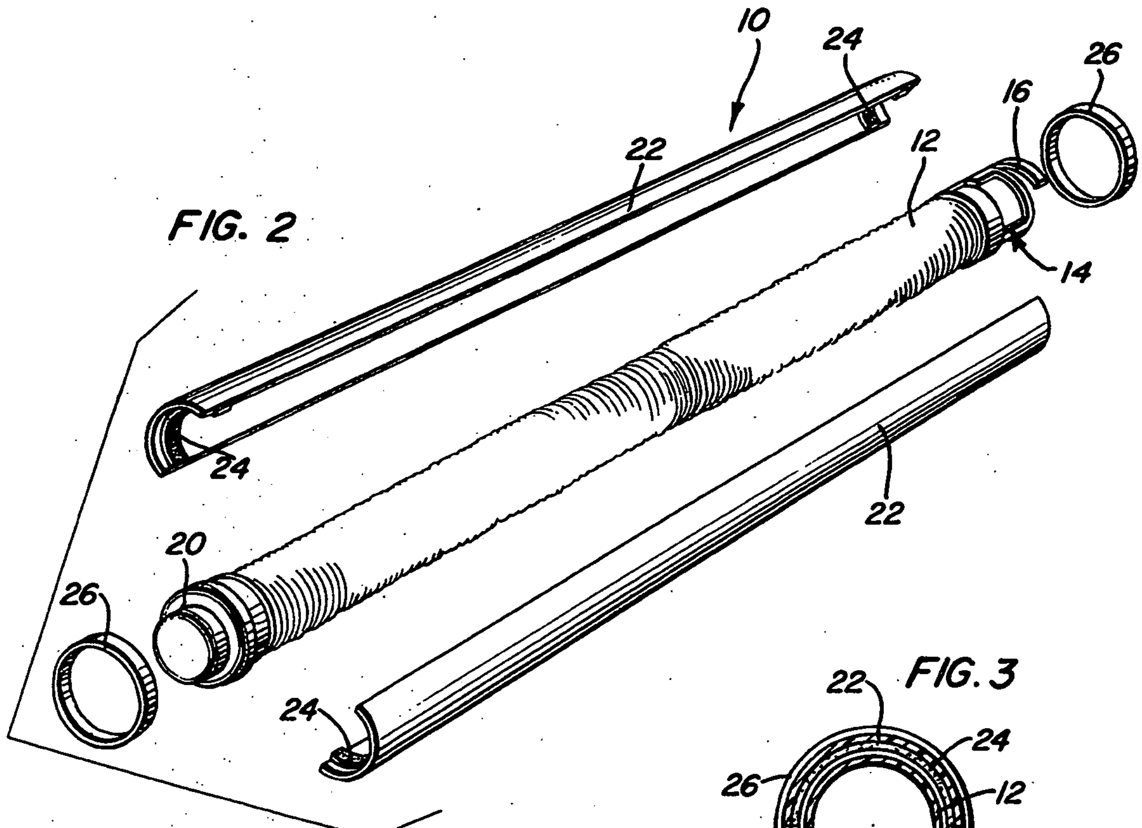
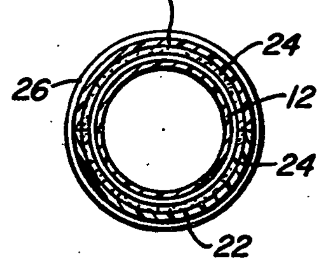


FIG. 3



SEWER CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to sewer connectors for recreational vehicles and especially to such sewer connectors which incorporate housings for the convenient storage of same.

2. Description of the Prior Art

Flexible connector hoses are conventionally used for connecting the waste drain of a recreational vehicle holding tank with a ground sewer connection. Such flexible hoses provide a convenient attachment device but are nevertheless endowed with certain inherent deficiencies. For instance, when carrying the hose, it is necessary to support it at several points in order to be sure that it will not drag upon the ground thereby causing injury to the hose. Furthermore, when attached for use, the hose should provide a straight line connection to the ground sewer in order that the sewage from the recreational vehicle will drain properly and not remain trapped within the hose itself.

In an attempt to overcome such deficiencies, a storage container has been developed as disclosed in U.S. Pat. No. 3,924,661, issued Dec. 9, 1975 to Bornhoffer. The Bornhoffer storage container comprises a cylindrical tubing element having a single axial slit thus allowing the element to expand to accept a compressed flexible hose therein. The construction shown by Bornhoffer has certain inherent disadvantages including the fact that direct contact is made between the hard casing element and the flexible hose thereby causing dents and chaffing to occur in the hose creating permanent injury thereto. Furthermore, the Bornhoffer device makes it inconvenient for inserting the hose into and removing the hose from the casing.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a sewer connector device including a two-part housing enclosing a flexible hose and thus allowing convenient access to the housing interior for inserting the hose into and removing the hose from the interior.

Another object of the present invention is to provide a sewer connector including circumferential pads which form the connection with the flexible hose in order to avoid contact between the housing and the hose thereby eliminating any possible damage to the hose.

A still further object of the present invention is to provide a sewer connector stand for holding the connector at a position spaced above the ground when not in use.

Yet another object of the present invention is to provide a sewer connector which includes slip rings for holding the two-part housing together which slip rings may conveniently be moved upon the housing to allow separation of the two parts of the housing.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the sewer connector attached to a recreational vehicle.

FIG. 2 is an exploded view of the sewer connector showing the constitutent elements thereof.

FIG. 3 is a sectional view taken substantially along a plane passing through section line 3—3 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Now with reference to the drawings, the sewer connector generally referred to by the numeral **10** will be described in detail. The sewer connector includes a length of standard flexible hose **12** which is typically compressible in an axial direction for providing a convenient compact configuration. Such hoses are normally designed to extend to a full length of approximately 20 feet and compress to a length of approximately 3 feet. The hose **12** has a plastic connector **14** at one end thereof. The connector has radially opposed bayonet slots **16** for connection to recreational vehicle **18**. The opposite end of the hose has affixed thereto a second connector **20** which may be simply an extension or a threaded device for connection to the existing ground sewer line.

The sewer connector housing structure comprises two identical semi-cylindrical housing halves **22**. The housing halves **22** may be produced from a single piece of cylindrical tubing portion which is split in half. Each housing half **22** is preferably made of polyvinyl chloride or any other suitable plastic material. The housing halves **22** fit together and form a cylindrical housing cover for the hose **12**. The cylindrical housing cover should have an interior diameter which is slightly greater than the exterior diameter of the hose **12**. A strip of foam rubber material **24** is affixed by gluing or any other suitable means to the interior of each end of each housing half **22**. Foam rubber strips **24** are the only other elements of the housing structure to make contact with hose **12**. In order to hold the halves **22** together and apply pressure from the foam rubber strips **24** to the hose **12**, rings **26** are provided and are slipped over the ends of the housing halves **22**. Rings **26** are preferably made of the same plastic material as the housing halves **24** and have an inside diameter equal to the outside diameter of the housing. With rings **26** in place, the two halves **22** are firmly held together and pressure is applied by the foam rubber stips **24** to the hose **12** thus preventing the hose from being extended or contracted axially.

In use, with connector **14** attached to the recreational vehicle **18**, one or the other ring **22** may be removed or slid to the opposite end of the housing as shown in FIG. 1 at **26'**. In this manner, the ring-free end may easily be opened for access to the interior of the housing to facilitate the insertion thereinto or removal therefrom of hose **12**, as illustrated in FIG. 1 by displayed housing half **22'** shown in phantom.

A sewer connector stand **28** as shown in FIG. 1, is also provided for conveniently holding the sewer connector vertically above the ground. The stand **28** includes a rectangular base frame **30** having a vertical rod **32** connected to one section thereof. Slidably disposed upon rod **32** is U-shaped holder **34** in which the hose **12** or housing **22** may be disposed. The holder **34** may be made of any suitable plastic or metal material and may

be attached to rod 32 by the use of set screws, thumb screws or any other suitable engagement means.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A connector device comprising in combination:

a flexible hose for carrying fluids therethrough, said hose being axially compressible and expandable for changing the working length of said hose; and

a housing comprising a pair of substantially semi-cylindrical housing halves for surrounding and protecting said hose, each housing half have a length which is substantially less than the extended length of said hose, engagement means disposed within and connected to said housing for engaging the outer periphery of said hose without causing injury to said hose by contact therewith, attachment means for providing a connection between the two housing halves for forming a firm engagement about said hose and forcing said engagement means into contact with said hose.

2. The device of claim 1 wherein said attachment means comprises a pair of annular rings having an inside diameter equal to the outside diameter of the said housing, said rings being slidably disposed in surrounding relation to said housing halves for holding said housing halves firmly together.

3. The device of claim 1 wherein said engagement means includes a strip of soft material attached to the interior circumference of each end of each housing half such that the soft material engages said hose when the housing halves are placed about said hose.

4. The device of claim 3 wherein said attachment means includes a pair of annular rings having an inside diameter equal to the outside diameter of said housing, said rings being disposed about the housing for holding said housing halves together.

5. The device of claim 1 wherein each housing half is produced from a semi-rigid plastic material.

6. The device of claim 1 wherein said hose has a connection means at one end for connecting said hose to the sewer outlet of a recreational vehicle.

7. The device of claim 1 and further in combination with a stand comprising a base, an upright rod, and a lateral extension slidably disposed on said rod for supporting said hose or said housing.

* * * * *

United States Patent [19]

Cook

[11] **4,223,702**

[45] **Sep. 23, 1980**

[54] **DRAIN LINE FOR RECREATIONAL VEHICLES**

[76] Inventor: **James Cook, P.O. Box 101, Sugarland, Tex. 77478**

[21] Appl. No.: **973,002**

[22] Filed: **Dec. 26, 1978**

[51] **Int. Cl.**[3] **F16K 27/12**; F16L 3/00

[52] **U.S. Cl.** **138/106**; 138/155; 138/178; 4/323; 137/355.12; 137/355.16; 137/355.2; 285/239; 285/302

[58] **Field of Search** 138/103, 106, 107, 120, 138/121, 155, 178; 285/62, 302, 239, 252, 31; 137/355.12, 355.16, 355.2; 239/195; 4/1, 114

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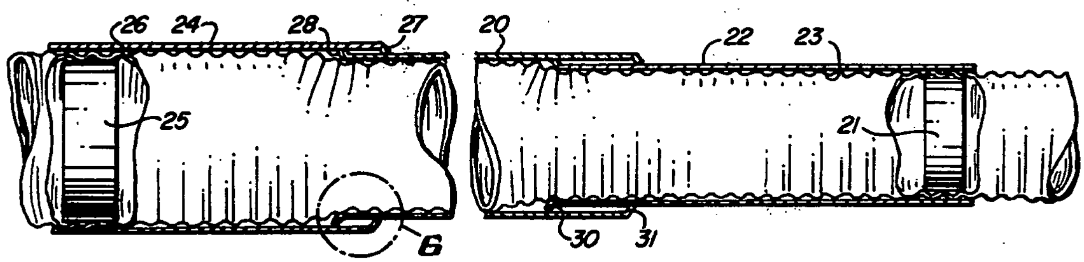
Primary Examiner—James E. Bryant, III
Attorney, Agent, or Firm—Duckworth, Hobby, Allen & Pettis

[57] **ABSTRACT**

A telescoping drain line for connecting recreational vehicles to a sewage system has telescoping rigid wall drain pipes having a plurality of pipe sections telescoping one within the other. A flexible hose extends through the telescoping pipes and out each end thereof and has means for attaching to a recreational vehicle drain at one end and into a sewage line opening at the opposite end thereof. The flexible hose is attached at each end of the telescoping rigid wall drain pipe to prevent the flexible pipe from collapsing or coming out of the rigid pipes. The flexible pipe will fold within the telescoping pipe for storage of the drain line.

9 Claims, 6 Drawing Figures



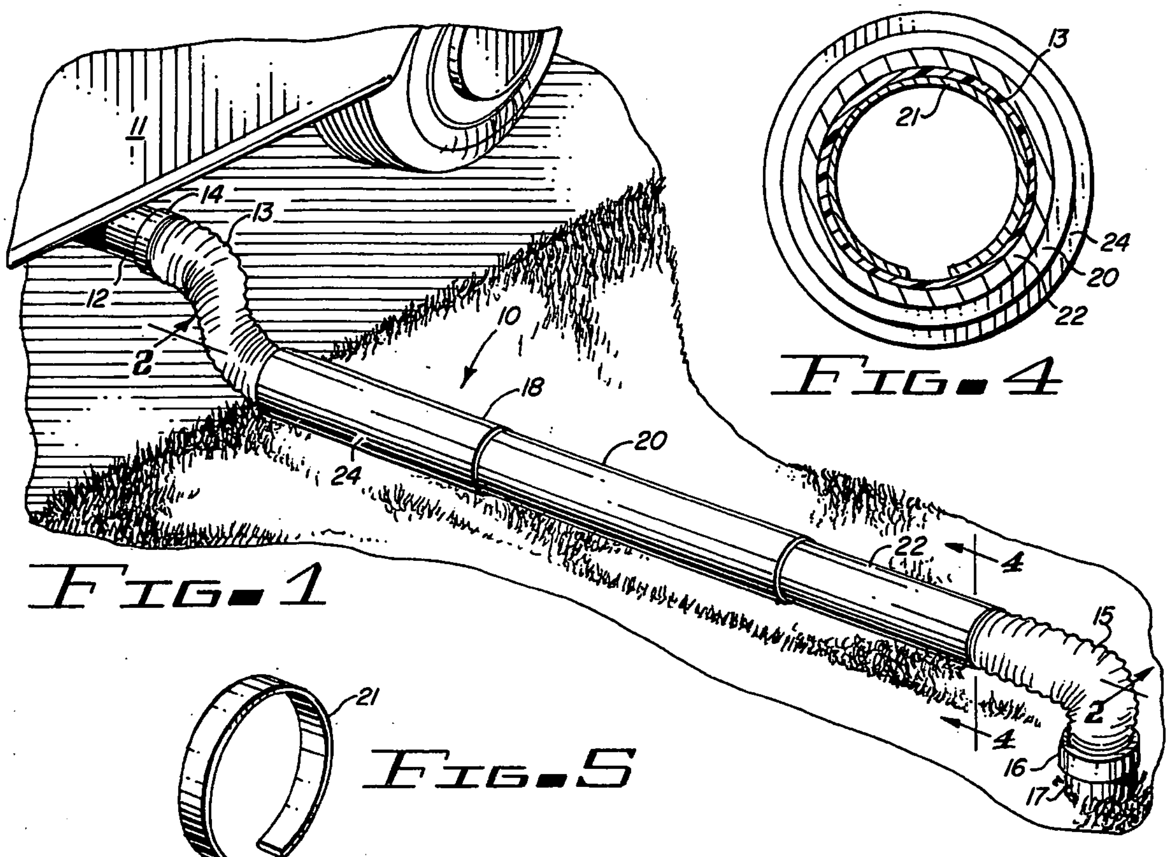


FIG. 1

FIG. 4

FIG. 5

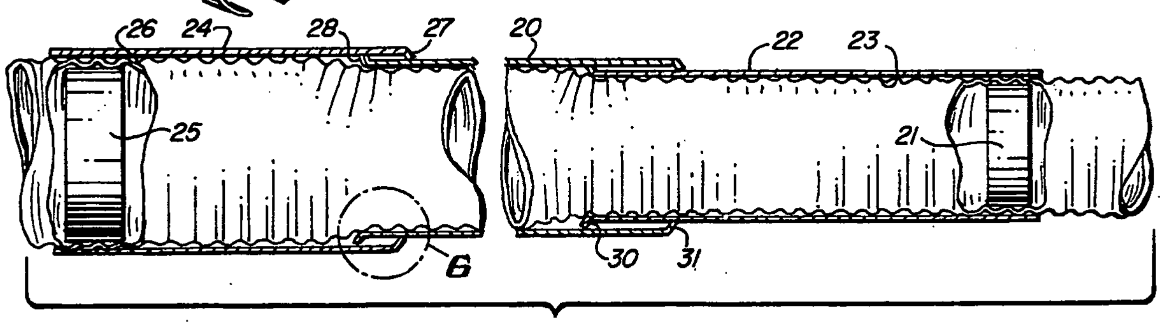


FIG. 2

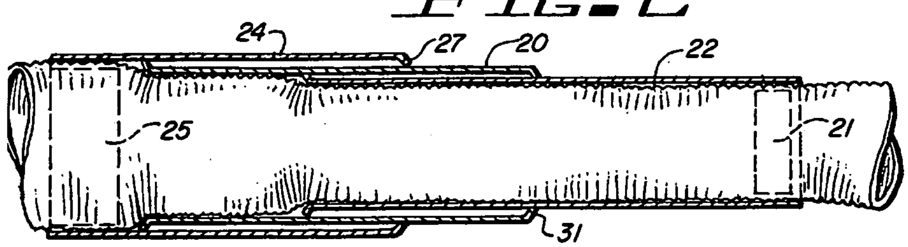


FIG. 3

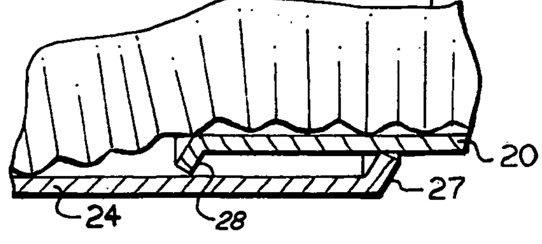


FIG. 6

DRAIN LINE FOR RECREATIONAL VEHICLES

BACKGROUND OF THE INVENTION

The present invention relates to a drain line for draining waste from recreational vehicles and especially to a telescoping drain line having a continuous flexible pipe passing therethrough.

DESCRIPTION OF THE PRIOR ART

Recreational vehicles that pull into campgrounds are required to connect their drain lines from their plumbing facilities in the recreational vehicle to a sewer hook-up provided by the campground. This generally requires a pipe that will extend varying distances for the hook-up. Presently a flexible hose is generally used which is stored in a compartment on the vehicle and is removed when the recreational vehicle is in service. The flexible hose is connected from the recreational vehicle or camper drain to the sewer facility provided. However, this requires special storage facility and when waste and waste water are discharged through the flexible line, the suction created on the flexible hose has a tendency to collapse the hose, thereby requiring additional support. To correct this problem, rigid wall telescoping sewer drains have been offered which have sliding members which extend the necessary length for hook-up and then retract for storage. This type of system can be seen in U.S. Pat. No. 3,730,228 for a Hose Case Assembly. This system works satisfactorily, but has several disadvantages, one of which is that soil tends to accumulate on the exterior wall when the rigid pipes are laid on the earth, and the soil in the smaller telescoping members gets on the larger members interior walls, damaging the seals between the telescoping members and resulting in leakage. In addition, the telescoping members require close fits and seals that will prevent leakage at any point of telescoping since the unit must be adjusted for a variety of different positions between the recreational vehicle and the sewer line. In another U.S. Pat. No. 3,819,137, a trestle for a flexible hose is provided in which a collapsing trestle supports the conventional flexible hose to provide a more direct gravity flow of the sewage to prevent accumulation in lower spots of the terrain. Other patents that might be of interest can be seen in U.S. Pat. No. 2,852,216 for a refueling conduit; U.S. Pat. No. 3,860,978 for a drain assembly for sinks and bathtubs utilizing a flexible hose; and U.S. Pat. No. 3,838,713 for a trailer and tube connection incorporating a flexible hose. In U.S. Pat. No. 3,760,430 an adapter apparatus for a portable sewage disposal system is provided for a flexible hose drain line connection.

The present invention is directed towards solving both the problem of collapsing rigid drain hose and preventing the accumulation of sewage from the uneven earth, and at the same time, avoiding the problems inherent in telescoping drain lines by having a flexible drain hose extending through a rigid telescoping pipe and fastened at each end so that the flexible hose can extend and contract with the telescoping pipe, but preventing any leakage or the use of special seals in the telescoping sections.

SUMMARY OF THE INVENTION

The present invention relates to a telescoping sewer drain hose for recreational type vehicles and has a telescoping rigid tubular wall drain pipe having a plurality of tubular sections telescoping one within the other. A flexible hose extends through the telescoping drain pipe and is attached at each end of the telescoping drain pipe to each of the end tubular telescoping sections so that the flexible pipe can contract and expand with the telescoping of the rigid pipes. Each end of the flexible pipe may have fitting clamps or assemblies for attaching to the drain line of the recreational vehicle and to the sewer inlet. The telescoping pipes can be held together by intersecting but oppositely directed flanges on the end of each telescoping section, while the connection of the flexible pipe to the rigid telescoping pipe can be with a spring loaded band located inside the flexible pipe and expanding against the interior wall of the rigid tubular section.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will be apparent from the written description and the drawings, in which:

FIG. 1 is a perspective view of a recreational vehicle drain line connected between a recreational vehicle and a sewer inlet;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a sectional view of a partially collapsed drain line of FIGS. 1 and 2;

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 1;

FIG. 5 is a perspective view of a spring loaded band for connecting the flexible hose to the rigid tubular sections;

FIG. 6 is an enlarged section taken on the circle 6 of FIG. 2;

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, a telescoping drain line connection **10** is connected to a recreational vehicle **11** at the drain pipe **12** in FIG. **1**. Drain line **10** has a flexible sewage hose **13** which is connected by a clamp or other fitting **14** to the recreational vehicle drain line **12**. At the opposite end **15** of the hose **13**, a second fitting assembly **16** can connect to a sewer inlet **17**. The telescoping rigid polymer pipe **18** is a plurality of telescoping tubular sections **20**, **22** or **24**, each of which may be a polymer or plastic material, each section being slightly smaller in size than the next section, so that one can telescope within the other. The flexible line **13** passes entirely through the rigid telescoping pipe **18** so that it forms one continuous line from the connection **14** on the recreational vehicle **11** drain line **12** to the sewer inlet **17** thereby preventing leakage in the drain line. The telescoping pipe **18** prevents the flexible line **13** from following contours in the earth and thereby accumulating waste and also preventing the collapse of the line. The line **13** is connected as shown in FIG. **2** by a spring loaded band **21** located inside the flexible hose **13** adjacent the end of one tubular section **22**, so that the band expands the hose **13** against the internal wall **23** of the tubular section **22**, thereby holding the flexible line **13** in position at that point, and simultaneously expanding it intermittent its ends and preventing the collapse of the line. At the opposite end of the tubular pipe **18**, the larger tubular section **24** has a second and larger spring loaded band **25** expanding against the inside of the hose **13** and against the internal wall **26** of the tubular section **24**. This also prevents the hose **13** from sliding out one end or the other of the pipe **18**. The drain pipe **18** tubu-

lar section **24** may have an inwardly turned flange 27 while the next adjacent tubular pipe **20** may slide internally of the pipe **24** and may include an alternately turned flange **28**, so that the flanges 27 and **28** will intersect when the pipes are extended their full length, preventing pipe **20** from sliding out of pipe **24**. The flanges also have the benefit, as shown in FIG. **6**, of preventing damage to the hose **13** by the curved flange **28** sliding against the hose **13** to fold it, but to allow it to slide between pipes during the telescoping of the pipe **18** for storage on the recreational vehicle when not in use. Similarly, pipe **22** has external flange **30** at one end protruding into the pipe **20**, which has an internally extending flange **31** for engaging the flange **30**. The flexible drain **13** requires no seals between the telescoping tubular sections **20**, **22** and **24**, to prevent leakage from between the telescoping tubular sections.

In operation, the pipe **18** is telescoped closed, as partially illustrated in FIG. **3**, and packed on the recreational vehicle. Upon arriving at a campsite, the drain line **10** is removed, the telescoping pipe portion is telescoped to the desired length, which simultaneously expands the flexible hose **13** located inside the telescoping pipe **18** between the steel bands **21** and **25**. The flexible hose **13** extending out either end of the pipe **18** can then be used to connect to the drain line **12** of the recreational vehicle **11** at one end and to the sewer **17** on the opposite end. In the sectional view of FIG. **4**, the tubular pipe can be seen having the largest telescoping tubular section **24** adjacent the telescoping tubular section **20**, which is adjacent the telescoping tubular section **22**, which has the flexible sewage hose **13** mounted thereinside by the spring loaded band **21**. It should be clear at this point that an improved drain line has been provided for recreational vehicles, campers, or the like, which can be manufactured for the most part from commercially available materials. The telescoping tubular sections **20**, **22** and **24** can be made of conventional polymer pipe, such as PVC, cut to size and having the ends flanged, while the flexible sewage hose **13** is commercially available, as are clamps and fitting assemblies for connecting to hose to the drain line and to the sewer inlet. The spring loaded expansion bands for compressing the flexible hose **13** to the tubular sections can be made from stainless steel or any other low corrosive resilient material desired.

The present invention is, accordingly, not to be construed as limited to the particular forms disclosed herein, which are to be regarded as illustrative rather than restrictive.

I claim:

1. A telescoping drain line for recreational vehicles, or the like, comprising in combination:
   - a telescoping rigid wall drain pipe having a plurality of sections telescoping one within the other;
   - a flexible hose extending through said telescoping rigid wall drain pipe for contracting and expanding with the telescoping of said telescoping rigid drain pipe; and
   - means for attaching said flexible hose to at least two telescoping rigid wall pipe sections between the ends of said flexible hose, whereby said flexible hose will expand or contract inside said telescoping rigid wall drain pipe responsive to the telescoping of said pipe.

2. The apparatus in accordance with claim **1**, in which the means for attaching said flexible hose to said telescoping rigid wall pipe sections includes a spring loaded arcuate band positioned inside said flexible hose for expanding said flexible hose against the interior wall of one section of said telescoping rigid wall drain pipe.

3. The apparatus in accordance with claim **2**, in which said flexible hose has a drain line fitting on one end thereof.

4. The apparatus in accordance with claim **3**, in which said flexible hose has a sewer inlet fitting on the other end thereof.

5. The apparatus in accordance with claim **4**, in which said telescoping rigid wall drain pipe has a plurality of tubular sections.

6. The apparatus in accordance with claim **5**, in which the largest tubular section of said telescoping rigid wall drain pipe has an annular flange on one end thereof directed towards the elongated axis of said tubular section.

7. The apparatus in accordance with claim **6**, in which the plurality of tubular sections of said telescoping rigid wall drain pipe includes a second tubular section telescopically mounted in the said largest tubular section and said second tubular section has an annular flange flanged away from the elongated axis thereof, whereby said annular flanges on said largest tubular member and said second tubular section will intersect to prevent the separation of said tubular sections.

8. The apparatus in accordance with claim **7**, in which each intersecting tubular section has intersecting annular flanges.

9. The apparatus in accordance with claim **8**, in which said telescoping rigid wall drain pipe is made of a polymer material, and said flexible hose is made of a second polymer material.

* * * * *

United States Patent [19]

Knutsen

[11] **4,231,595**

[45] **Nov. 4, 1980**

[54] **WASTE DISPENSING DEVICE FOR RECREATIONAL VEHICLES AND THE LIKE**

[76] Inventor: **Karl I. Knutsen,** 9844 James Cir., Bloomington, Minn. 55431

[21] Appl. No.: **964,672**

[22] Filed: **Nov. 29, 1978**

[51] **Int. Cl.**[2] **F16L 35/00**

[52] **U.S. Cl.** **285/38;** 137/899.3; 137/355.16; 285/62; 285/299; 285/423; 285/DIG. 2; 285/DIG. 16

[58] **Field of Search** 285/DIG. 2, 16, 62, 285/299, 423, 376, 302, 301, 300, 227, 381; 138/106; 137/344, 355.16; 144/382-388

[56] **References Cited**

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4,133,347	1/1979	Mercer	285/423 X

FOREIGN PATENT DOCUMENTS

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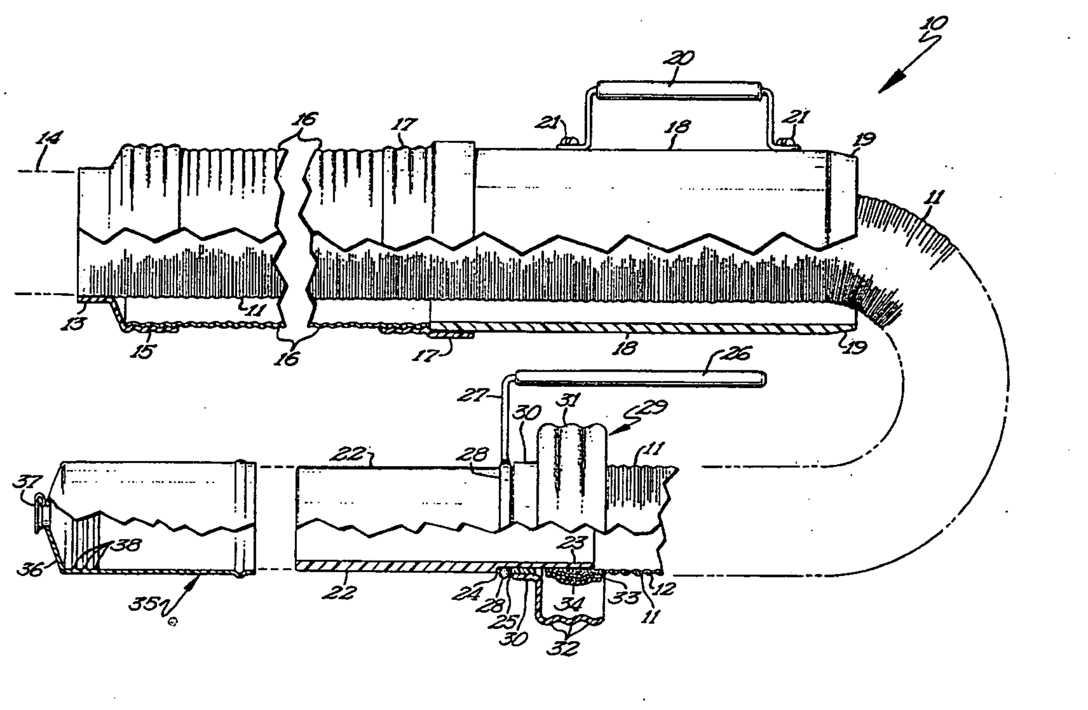
Primary Examiner—Dave W. Arola

Attorney, Agent, or Firm—Williamson, Bains, Moore & Hansen

[57] **ABSTRACT**

A waste dispensing device for recreational vehicles includes an elongate longitudinally compressible and extensible hose which is connected to the waste outlet fitting of a recreational vehicle. The dispensing device includes an exterior housing structure which is secured to and positioned around that end portion of the hose which is connected to the recreational vehicle. The hose may be longitudinally retracted and contained within the exterior housing structure when the vehicle is being moved, and conversely, the hose may be longitudinally extended for connection to a waste disposal system, when the vehicle is stationary.

4 Claims, 1 Drawing Figure



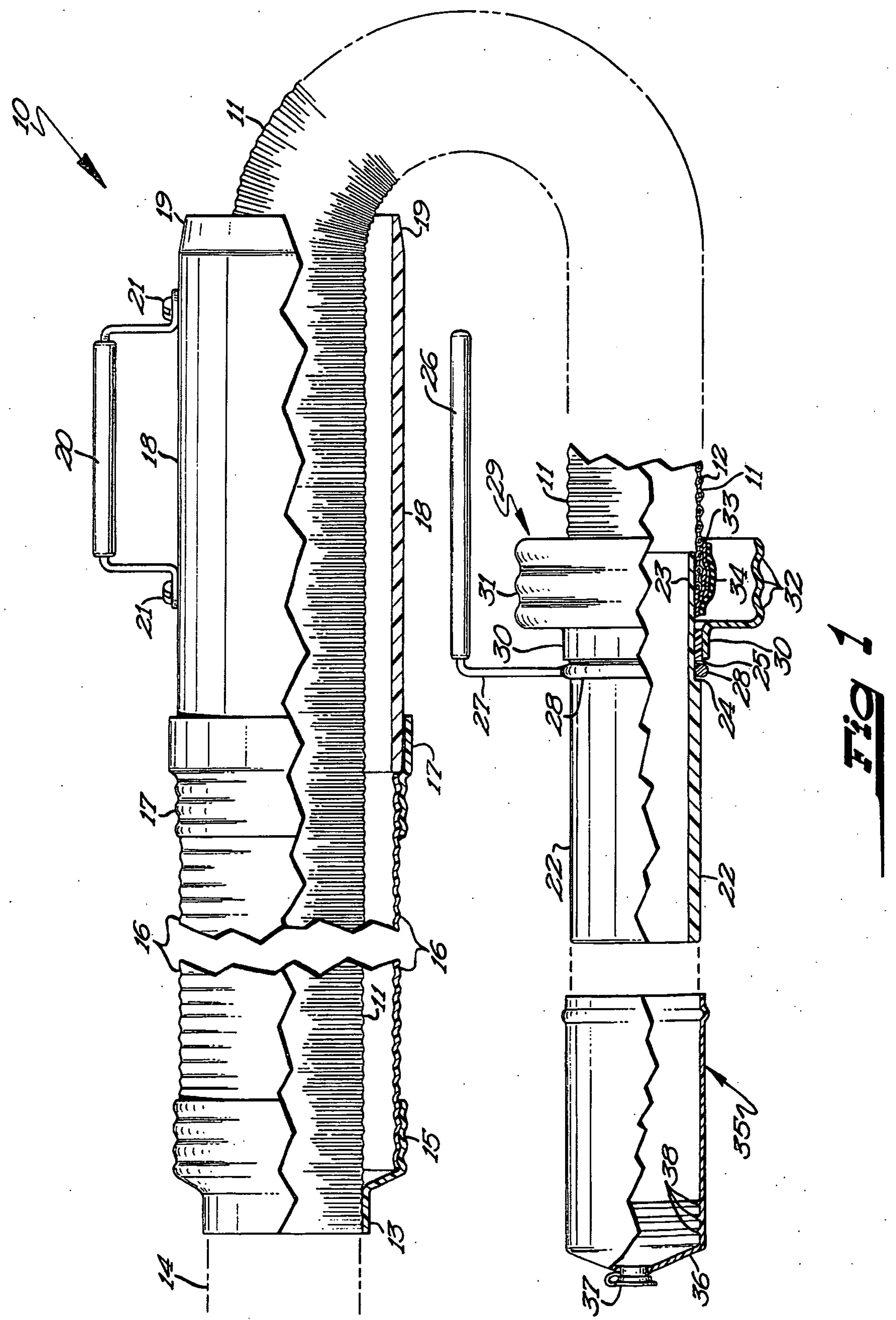

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Fig 1

WASTE DISPENSING DEVICE FOR RECREATIONAL VEHICLES AND THE LIKE

SUMMARY OF THE INVENTION

This invention relates to waste dispensing devices and more particularly to a waste dispensing hose and housing therefor for use with recreational vehicles.

An object of this invention is to provide a novel waste dispensing device including a flexible, extensible and retractable dispensing hose which may be readily extended for use in dispensing waste when the vehicle is parked, and which may be readily retracted to a stored position when the vehicle is being moved.

A more specific object of this invention is to provide a waste dispensing device, of simple and inexpensive construction, including a hose which is adapted to be connected to the conventional waste outlet fitting of a recreational vehicle, and an exterior housing for the hose in which the hose may be retracted to thereby protect the waste dispensing hose during travel of the recreational vehicle.

These and other objects and advantages of this invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views.

FIGURES OF THE DRAWINGS

FIG. 1 is a side elevational view of the novel wast dispensing device with parts thereof broken away and being foreshortened for clarity.

PREFERRED EMBODIMENT OF THE INVENTION

Referring now to the drawing, it will be seen that one embodiment of my novel waste dispensing device, designated generally by the reference numeral 10, is there-shown. The waste dispensing device 10 is adapted for use with recreational vehicles and is intended to be connected to the waste outlet fitting of a recreational vehicle through which waste material is dispensed. Typically, the outer end of the waste dispensing device is adapted to dispense the waste material into a waste disposal system.

The waste dispensing device 10 includes an elongate, flexible inner tubular member or hose 11 which is formed of a liquid impervious material, preferably vinyl, and has a helical spring 12 embedded therein. It will be noted that the hose 11 has a bellows type construction and is longitudinally extensible and retractable as well as being flexible. One end of the inner hose 11 is connected to an annular coupling element 13 which is adapted to be connected to the waste outlet fitting 14 of a recreational vehicle. It will be noted that the coupling element 13 has an enlarged annular portion 15 to which is connected one end of an outer flexible tubular member or hose 16. The outer tubular member 16 although having a larger diameter than the inner hose 11, is of the same construction and is formed of a vinyl material having a helical spring embedded therein. Thus, this outer tubular member 16 is capable of flexure during use.

In this regard, it is pointed out that typically the inner hose 11 when in an extended position has a length dimension of ten or twenty feet. On the other hand, the outer tubular member 16 typically has a length dimension of approximately twelve inches. It is pointed out that the length of the inner tubular member is optional and may be as long as twenty feet in its extended position.

The rear or other end of the outer tubular member 16 is glued to a sleeve element 17, and the sleeve element sealingly secured, as by glueing, to one end of an elongate cylindrical sleeve 18. It will be noted that the rear or other end of the sleeve 18 is tapered as at 19. It is also pointed out that the sleeve 18 has a diameter larger than the diameter of the inner hose 11 and has a length dimension corresponding substantially to the length dimension of the outer tubular member 16. The sleeve 18 is provided with a U-shaped handle 20 having suitable securing elements, such as bolts 21, which secure the U-shaped handle to the sleeve adjacent the mid-portion thereof. The sleeve 18 and the outer tubular member 16 constitute an exterior housing in which the hose 11 is disposed when the latter is in the retracted position.

The hose 11 has an elongate, rigid cylindrical spout 22 secured to its other end and projecting therefrom. In the embodiment shown, the rigid spout has one end portion thereof relieved or reduced as at 23 which projects interiorly of the hose 11 and is glued thereto. The reduced end portion of the spout defines an annular shoulder 24, and an annular sleeve is positioned around the exterior portion of the hose 11 and is glued thereto but is spaced from the shoulder 24 so that a groove is defined between one end of the sleeve 25 and the shoulder 24. An L-shaped handle 26 having a leg 17 is provided with an annular attachment ring 28 which is positioned within the groove defned by the shoulder 24 and the sleeve 25. The annular attachment ring permits the L-shaped handle to rotate relative to the hose 11.

A clamping cap 29 includes an annular attachment portion 30 which is positioned around and is secured by glueing to the sleeve 25. The clamping cap 29 also includes a generally cylindrical enlarged clamping portion 31 which is provided with internal ridges 32 which are adapted for sealing engagement with the exterior surface of the rigid sleeve 18. In order to provide a fluid seal between the hose connection 11 and the spout 22, sealing tape 33 is applied to the exterior surface of the hose and a heavy rubber sealing band 34 is positioned around the tape 33. It will be noted that these sealing elements are positioned interiorly of the clamping cap 29.

The dispensing device 10 also includes an elongate sanitary self-sealing cap 35 which is of cylindrical configuration and which is formed of a rigid material. The sanitary cap 35 has an end portion 36 having an opening therein which is closed by conventional drain plug 37. The sanitary cap 35 is also provided with internal grooves 38 which form a fluid seal with the exterior surface of the spout 22.

In use, the coupling element 13 will be connected to the outlet fitting 14 of the recreational vehicle, and the hose 11 will be extended to its extended position when the recreational vehicle is parked, for example, at a campsite. The sanitary cap 35 will be removed from the spout 22 and the user will grip the handle 26 and pull the spout for insertion into a sewage disposal system. Liquid entrained waste material will be directed through the hose 11 into the conventional sewage disposal system at the campsite.

It is pointed out that the sleeve 18 may be supported or secured to a bracket carried by the vehicle or may be connected to any conventional adjacent structure on

the recreational vehicle. When it is desirable to move the vehicle, a user merely removes the spout from its connected relation to the sewage disposal system and places the sanitary cap over the end of the spout. Thereafter, the hose may be compressed into the housing structure defined by the sleeve **18** and the outer tubular member **16** until the clamping cap engages the end of the sleeve **18**. In this mode, the hose **11** will be compressed to substantially less than one-half of its overall length and will be conveniently stored within the housing structure for travel.

From the foregoing, it will be seen that I have provided a novel waste dispensing device which is not only of simple and inexpensive construction, but one which functions in a more efficient manner than any heretofore known comparable device.

What is claimed is:

1. A waste dispensing device for recreational vehicles and the like comprising:

an elongate, flexible inner tubular member being longitudinally retractable and extensible between an extended position and a retracted position,

a coupling element secured to one end of said tubular member and being adapted to be attached to the waste outlet fitting of a recreational vehicle,

an elongate, rigid spout secured to the other end of said tubular member and projecting longitudinally therefrom,

an elongate, exterior housing structure positioned around said inner tubular member and including an elongate rigid cylindrical sleeve and an elongate flexible outer tubular member, said outer tubular member having one end thereof connected to said coupling element and having the other end thereof connected to said rigid sleeve, said exterior housing structure having a length dimension substantially less than one-half the length dimension of the inner tubular member when the latter is in the extended position,

an annular clamping cap positioned around and connected with said spout, the clamping cap releasably engaging an end portion of said rigid sleeve to retain the inner tubular member in a retracted position within said exterior housing structure.

2. The dispensing device as defined in claim **1** wherein said clamping cap is spaced inwardly from the outer end of said rigid spout.

3. The dispensing device as defined in claim **1** and a handle revolvably mounted on said dispensing device adjacent said spout.

4. The dispensing device as defined in claim **1** wherein said clamping cap extends radially outwardly at said spout adjacent the inner end thereof.

* * * * *

United States Patent [19]
Smith

[11] Patent Number: 4,650,224
[45] Date of Patent: Mar. 17, 1987

[54] APPARATUS FOR DISCHARGING SEWAGE FROM TRAVEL TRAILERS AND THE LIKE

[76] Inventor: Donald E. Smith, 26486 Thompson Rd., Perrysburg, Ohio 43551

[21] Appl. No.: 780,435

[22] Filed: Sep. 25, 1985

[51] Int. Cl.[4] F16L 15/02
[52] U.S. Cl. 285/165; 285/226; 285/302; 285/376; 137/899
[58] Field of Search 285/165, 226, 237, 302, 285/361, 376, 402, 423; 141/382, 387, 388; 137/899

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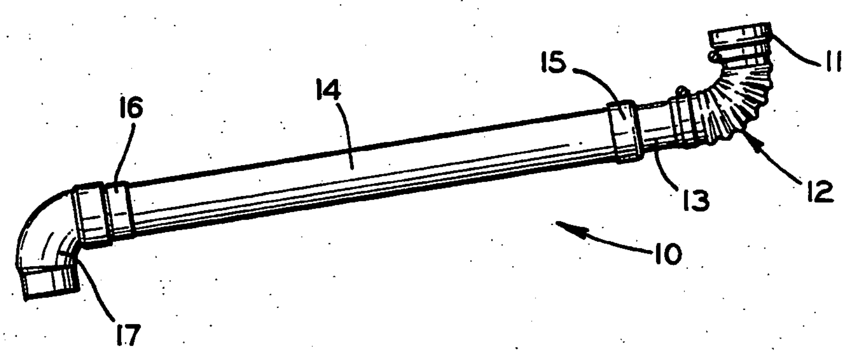
Primary Examiner—Cornelius J. Husar
Assistant Examiner—Anthony Knight
Attorney, Agent, or Firm—Marshall & Melhorn

[57] ABSTRACT

An apparatus for discharging sewage from a holding tank on a travel trailer or the like to a sewer inlet includes a flexible inlet coupling section for connecting to the discharge fitting on the holding tank, an L-shaped fixed outlet coupling section for insertion into the sewer opening, and a telescoping tube section connected to the inlet and outlet coupling sections. The joints or connection points to the flexible inlet coupling sections are sealed by hose clamps, and the connection between the tube sections and the connection between one end of the tube sections and the outlet coupling section are sealed with locking couplings having "O" rings. The flexible coupling and telescoping section accommodate various positions of the holding tank relative to the sewer inlet. A rigid tube section can be inserted between the telescoping tube section and the outlet coupling section to further increase the length of the sewage discharge apparatus.

14 Claims, 4 Drawing Figures



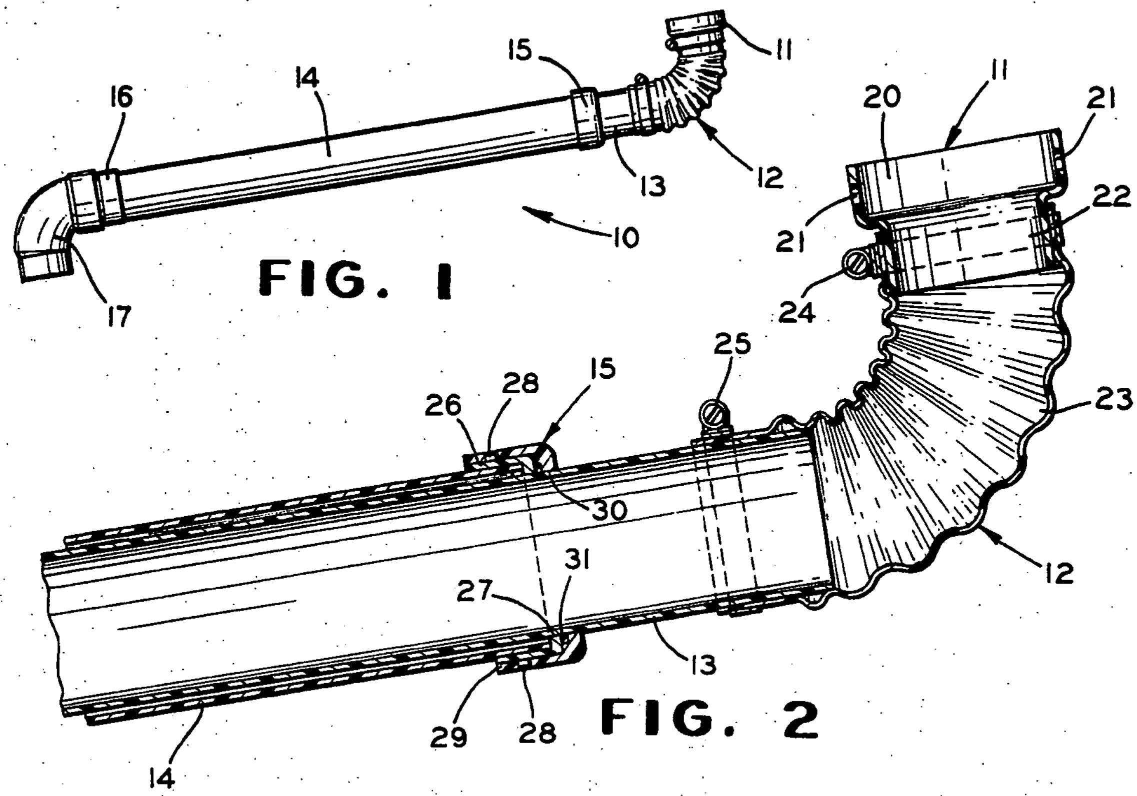


FIG. 1

FIG. 2

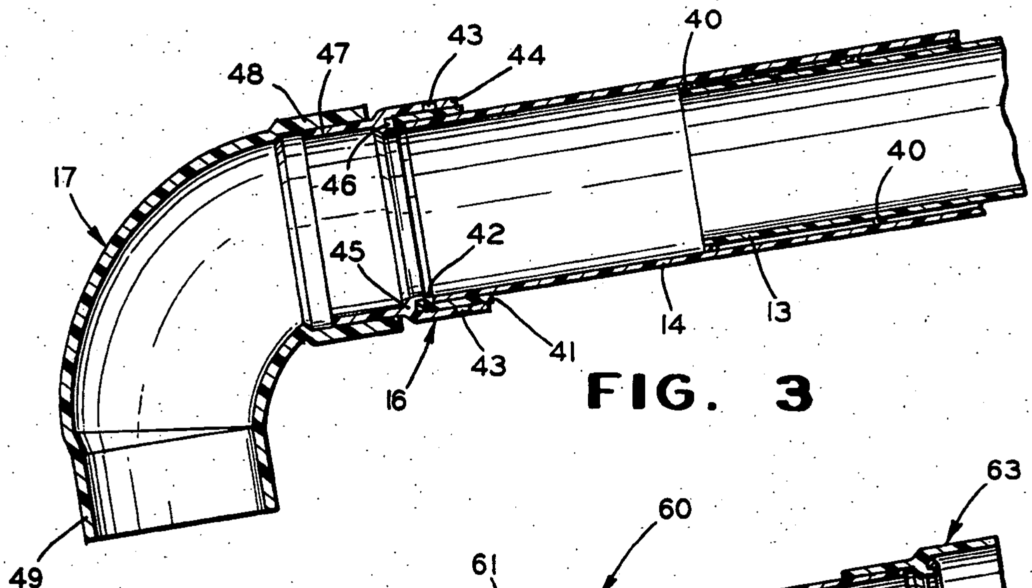


FIG. 3

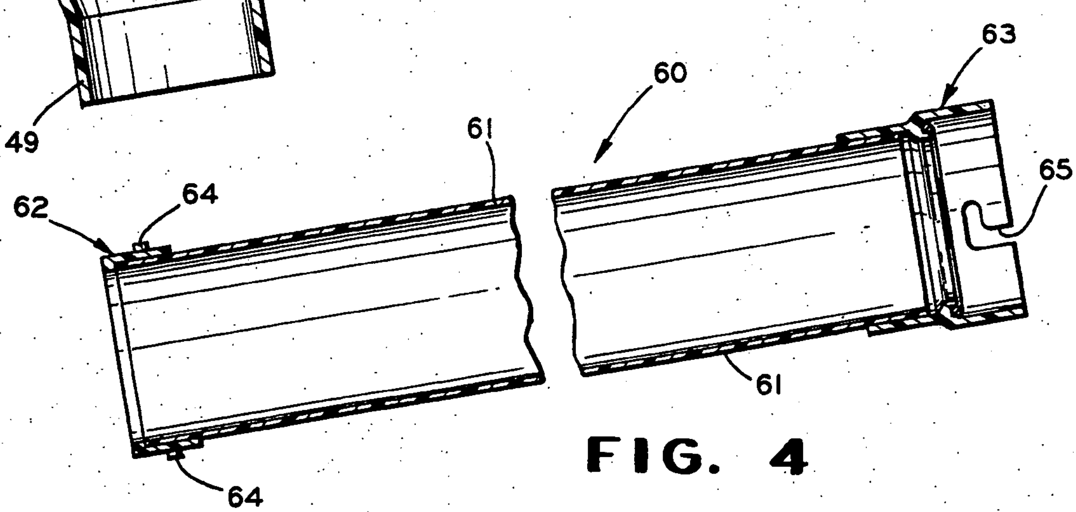


FIG. 4

APPARATUS FOR DISCHARGING SEWAGE FROM TRAVEL TRAILERS AND THE LIKE

FIELD OF THE INVENTION

The present invention relates generally to a sewage discharge device and in particular to a device for temporarily connecting a holding tank in a travel trailer or the like to a drain.

DESCRIPTION OF THE PRIOR ART

As travel has become more popular, many individuals and families have purchased travel trailers, motor homes and the like having holding tanks for retaining sewage generated during use. When it is time to empty the holding tank, typically a flexible hose is connected between a standard discharge coupling on the holding tank and a sewer or collection tank. A flexible hose is utilized because it is capable of extension and contraction to compensate for the relative positions of the holding tank outlet and the collection point. It is desirable that the hose be supported in such a manner as to enable the sewage to gravitate from the holding tank to the sewer without sags in the hose in which sewage may accumulate and freeze, and in such a manner that the hose is protected against damage. It is also desirable that the hose be supported such that it can be handled in a sanitary manner without the sewage coming in contact with the user. Furthermore, it is desirable that the hose and its support be capable of being stored in as small a space as possible when not in use.

A prior art hose supporting device is disclosed in U.S. Pat. No. 3,730,228 issued on May 1, 1973. There is shown in that patent a hose case for supporting and enveloping a flexible hose, which case is capable of longitudinal extension and contraction in any position of extension and contraction of the hose. The case is formed of a plurality of telescoping tubular sections, through which the hose extends, that can be relatively extended and contracted in correlation with the extension and contraction of the hose. One disadvantage of this device is that is must be supported in the desired position by two pairs of legs which are pivotly connected to the telescoping case. When in use, the legs must be pivoted in a downward direction to engage the ground and then pivoted upward for storage. Of course, this device is difficult, if not impossible, to utilize when the supporting ground is uneven or is not available and is bulky to store.

SUMMARY OF THE INVENTION

The present invention is concerned with a sewage discharge apparatus having a telescoping tubular body with one end connected to a flexible hose and fitting for connection to a standard discharge outlet coupling on a holding tank. The other end of the telescoping tube is connected to an L-shaped discharge pipe for insertion into a sewer inlet opening. In addition, a quick disconnect coupling can be utilized for permitting the insertion of a fixed length extension tube between the telescoping tube section and the L-shaped discharge pipe where the distance between the holding tank and the sewer inlet exceeds the maximum extended length of the discharge apparatus. When not in use, the discharge apparatus telescopes to its minimum length for easy storage.

It is an object of the present invention to provide a sewage discharge device for travel trailers and the like which can be easily operated and stored.

It is a further object of the present invention to provide a sewage discharge apparatus for travel trailers and the like which is economical to manufacture and assemble.

It is a further object of the present invention to provide a sewage discharge apparatus for travel trailers and the like which can be adapted to connect a holding tank discharge outlet to a sewer inlet from a wide variety of relative locations of the inlet and the outlet.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of a sewage discharge device according to the present invention shown in a partially extended position;

FIG. 2 is an enlarged cross-sectional view of the inlet coupling section of the sewage discharge apparatus shown in FIG. 1;

FIG. 3 is an enlarged cross-sectional view of the outlet coupling section of the discharge apparatus shown in FIG. 1; and

FIG. 4 is a cross-sectional view of an extension section for use with the outlet coupling section shown in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is shown in FIG. 1, a front elevational view of a sewage discharge apparatus **10** in accordance with the present invention. A standard fitting **11** is adapted to connect to a holding tank discharge outlet coupling (not shown) of the type which is typically attached to the holding tanks of travel trailers, motor homes and the like. The fitting **11** is attached to one end of an inlet coupling section **12** which is typically formed of a flexible hose. The opposite end of the inlet coupling section **12** is attached to an inner tube section **13** which telescopes inside an outer tube section **14**. The end of the outer tube section **14** into which the inner tube section **13** extends is sealed against leakage by a locking coupling **15**. The opposite end of the outer tube section **14** is attached to a locking coupling **16** which in turn is attached to a fixed outlet coupling section **17**. The open of the outlet coupling section **17** is adapted to be inserted into a sewer inlet opening such that the sewage discharge apparatus **10** provides a closed conduit for the discharge of sewage from a holding tank to a sewer.

As shown in FIG. 2, the fitting **11** has a larger diameter open end **20** having a pair of coupling slots **21** formed in the walls thereof for cooperation with a locking device on the holding tank discharge outlet coupling (not shown). The fitting **11** also has a smaller diameter end **22** which snuggly fits inside one end of the flexible inlet coupling section **12**. The coupling section **12** includes a length of flexible hose **23** which is firmly attached to the fitting **11** by a standard hose clamp **24**. The clamp **24** encircles the outer end wall of the hose **23** and clamps the inner wall of the hose firmly against the outer wall of the smaller diameter end **22** of the fitting **11** to achieve a fluid tight seal.

The opposite end of the flexible hose **23** receives an end of the inner tube section **13** and is attached thereto by a standard hose clamp **25** which encircles the outer surface of the end of the flexible hose **23**. The clamp **25** firmly holds the inner wall of the hose **23** against the

outer surface of the end of the inner tube section **13** to achieve a fluid tight seal. The other end of the inner tube section **13** telescopes inside the outer tube section **14**. The inner tube section **13** can be formed of a standard 2½" inside diameter polyvinylchloride pipe, for example, while the outer tube section **14** can be formed from a standard 3" inside diameter polyvinylchloride pipe. The locking coupling **15** includes an inner ring **26** which accepts the end of the outer tube section **14**. An inwardly extending radial flange **27** is formed at one end of the ring **26** to abut the end of the outer tube section **14** and the ring **26** is attached to the tube section **14** by a suitable adhesive.

Typically, a pair of ears or posts **28** extend radially outwardly from the outer wall portion of the inner ring **26** and engage slots formed in the wall of an outer ring **29**. The bottom wall of the outer ring **29** has an inwardly extending flange **30** formed at one end thereof to abut the flange **27**. A circumferentially extending "O" ring groove is formed about the inner edge of the flange **30** to accept an "O" ring **31**. When the outer ring is engaged with the inner ring **26**, the ears **28** engage the coupling slots formed in the outer ring **29** to lock the rings together and the "O" ring **31** is compressed between the inner ring flange **27** and the outer ring flange **30** to seal against the outer surface of the inner tube section **13** as the tube **13** is moved into and out of the interior of the outer tube section **14**.

At the opposite end of the inner tube section **13** there can be attached to the outer surface one or more circumferential seals **40** which seal against the inner surface of the outer tube section **14** as shown in FIG. 3. The other end of the outer tube section **14** is attached to th locking coupling **16**. The coupling **16** is similar to the locking coupling **15** in that an inner ring **41** is attached to and accepts the end of the outer tube section **14**. An inwardly extending flange **42** is formed at one end of the inner ring **41** to abut the end of the outer tube section **14**. A pair of radially outwardly extending ears or posts **43** are formed on an outer surface of the inner ring **41** and engage slots formed in the walls of an outer ring **44**. The outer ring **44** has an inwardly radially extending step **45** formed on the inner wall thereof including an "O" ring groove for accepting an "O" ring **46**. When the outer ring **44** is rotated into engagement with the inner ring **41**, the ears or posts **43** engage the slots in the outer ring **44** and lock the two rings together. In this position, the "O" ring **46** is compressed to seal the connection between the rings **41** and **44**.

The outer ring **44** also includes a tubular extension **47** which extends inside one end of an L-shaped outlet coupling section **17**. The coupling section **17** can be formed from a standard "L" coupler made of polyvinylchloride material. The coupling section **17** includes a female end **48** for accepting the extension **47** and a male end **49** which fits into a sewer inlet (not shown). The inner ring **41** can be attached to the outer tube section **14** and the extension **47** can be attached to the female end **48** with a suitable adhesive for fluid tight seals.

When the sewage discharge apparatus **10** is to be stored, the inner tube section **13** is telescoped inside the outer tube section **14** to reduce the length of the apparatus to a minimum. The apparatus is then ready for storage in any suitable space in a travel trailer, motor home or the like. When it is time to utilize the apparatus **10**, the fitting **11** is connected to the discharge outlet coupling on the holding tank to be emptied and the inner tube section **13** is extended from the outer tube section **14** a distance sufficient to place the male end **49** of the coupling section **17** at the inlet of a sewer. The flexible inlet coupling section **12** accommodates various angles created by the relative positions of the holding tank and the sewer.

There is shown in FIG. 4, an extension section for the sewage discharge apparatus in accordance with the present invention. The extension section permits the fixed outlet coupling section **17** to be disconnected from the tube section **14** for the insertion of the extension section to accommodate distances which are longer than the fully extended length of the sewage discharge apparatus **10** of FIG. 1.

There is shown in FIG. 4 an extension section **60** for use with the sewage discharge apparatus **10**. The extension section **60** includes a tubular pipe **61** having a male coupler **62** attached at one end and female coupler **63** attached at the other end thereof. The couplers **62** and **63** are similar to the locking coupler **16** of FIG. 3. A pair of post **64** formed on the male coupler **62** extend radially outwardly to cooperate with the slots formed in the outer ring **44** of FIG. 3. The female coupler **63** has a pair of slots **65** (only one is shown) formed therein for cooperation with the posts **43** of FIG. 3. Therefore, the extension section **60** can be inserted between the locking coupling **16** and the outer tube section **14**. The extension section **60** is utilized in case the distance between the holding tank outlet and the sewer inlet is greater than the maximum extended distance of the sewage discharge apparatus **10**. The extension section **60** can be formed of any suitable length and more than one such extension section can be utilized to provide the necessary spacing between the flexible inlet coupling section **12** and the fixed outlet coupling section **17**.

In accordance with the provisions of the patent statutes, the principle and mode of operation of the invention have been explained in its preferred embodiment. However, it must be understood that the invention may be practiced otherwise than specifically illustrated and described without departing from its spirit or scope.

What is claimed is:

1. A sewage discharge apparatus for connecting a source of sewage to a desired destination for the sewage comprising:

an inlet coupling section having a fitting attached to one end thereof, said fitting having a larger diameter opening for coupling to an outlet fitting attached to a source of sewage and a smaller diameter opening, and a flexible tube with said smaller diameter opening extending into and attached to one end and having an oppsite end;

a telescoping section having an inner tube section telescoping inside an outer tube section and having one end of said inner tube section connected to said opposite end of said inlet coupling section; and

an outlet coupling section including a generally L-shaped tube having one end connected to an opposite end of said telescoping section and having an opposite end with means for connection to a destination for sewage, whereby said flexible tube and said telescoping section are each slectively adjustable for accommodating different relative positions of a source of sewage to be emptied and a destination for the sewage, said outlet coupling section including a locking coupling having an inner ring attached to said outer tube section, an outer ring attached to said generally L-shaped tube, and lock-

ing means for releasably attaching said inner ring to said outer ring.

2. The apparatus according to claim 1 including a hose clamp encircling an outer surface of said flexible tube for attaching said flexible tube to said fitting in a fluid tight relationship.

3. The apparatus according to claim 1 wherein said flexible tube is formed from a length of flexible hose.

4. The apparatus according to claim 1 wherein said inlet coupling section includes said flexible tube having said opposite end open for accepting said one end of said inner tube section, and further includes a hose clamp encircling said flexible tube to firmly connect said flexible tube to said inner tube section in a fluid tight relationship.

5. The apparatus according to claim 1 wherein said locking means includes at least one radially outwardly extending post formed on said inner ring for cooperation with at least one slot formed in a wall of said outer ring.

6. The apparatus according to claim 1 including an "O" ring positioned between said inner ring and said outer ring for sealing against fluid flow between said inner and outer rings.

7. The apparatus according to claim 1 including another locking coupling having another inner ring attached to said outer tube section, another outer ring slidably engaging said inner tube section, and another locking means for releasbly attaching said another inner ring to said another outer ring.

8. The apparatus according to claim 7 wherein said another locking means includes at least one radially outwardly extending post formed on said another inner ring for cooperation with at least one slot formed in a wall of said another outer ring.

9. The apparatus according to claim 7 including an "O" ring positioned between said another inner ring and said another outer ring for sealing against fluid flow between said another inner and outer rings.

10. The apparatus according to claim 7 including an "O" ring positioned between said another outer ring and an outer surface of said inner tube section for sealing against fluid flow between said another outer ring and said inner tube section.

11. A sewage discharge apparatus for connecting a discharge outlet of a holding tank in a travel trailer or the like to a destination for the sewage in the holding tank comprising:

an inlet coupling section having a fitting for connection to a discharge outlet of a holding tank and a flexible hose section having one end connected to said fitting;

a telescoping section having an inner tube section connected at one end to an opposite end of said flexible hose section and an outer tube section having one end for accepting an opposite end of said inner tube section, said inner and outer tube sections telescoping with one another; and

an outlet coupling section having a generally L-shaped tube with one end connected to an opposite end of said outer tube section and an opposite end for discharging sewage, whereby said flexible hose section and said telescoping section are selectively adjustable for accommodating different relative positions of a holding tank to be emptied and a destination for sewage in the holding tank, said outlet coupling section including a locking coupling having an inner ring attached to said outer tube section, an outer ring attached to said generally L-shaped tube, and locking means for selectively releasably attaching said inner ring to said outer ring.

12. The apparatus according to claim 11 wherein said locking coupling includes an extension section connected between said outer ring and said generally L-shaped tube.

13. The apparatus accroding to claim 11 including another locking coupling attached to said outer tube section and having means to seal against fluid flow from an interior to an exterior of said telescoping section between said inner and outer tube sections.

14. The apparatus according to claim 11 wherein said locking coupling includes means to seal against fluid flow from an interior to an exterior of said telescoping section between said outer tube section and said generally L-shaped section.

* * * * *

United States Patent [19]

Sargent et al.

[11] **Patent Number: 4,779,650**

[45] **Date of Patent: Oct. 25, 1988**

[54] **TELESCOPING DRAIN ASSEMBLY FOR RECREATIONAL VEHICLES**

[75] Inventors: **Charles L. Sargent; John M. Antos,** both of Ann Arbor; **George Grech,** Garden City, all of Mich.

[73] Assignee: **Thetford Corporation,** Ann Arbor, Mich.

[21] Appl. No.: **114,083**

[22] Filed: **Oct. 27, 1987**

[51] **Int. Cl.⁴** **E21B 43/24**

[52] **U.S. Cl.** **137/899;** 137/599.2; 137/615; 285/165; 285/302

[58] **Field of Search** 137/615, 899, 599.2; 251/299, 298; 285/165, 299, 302

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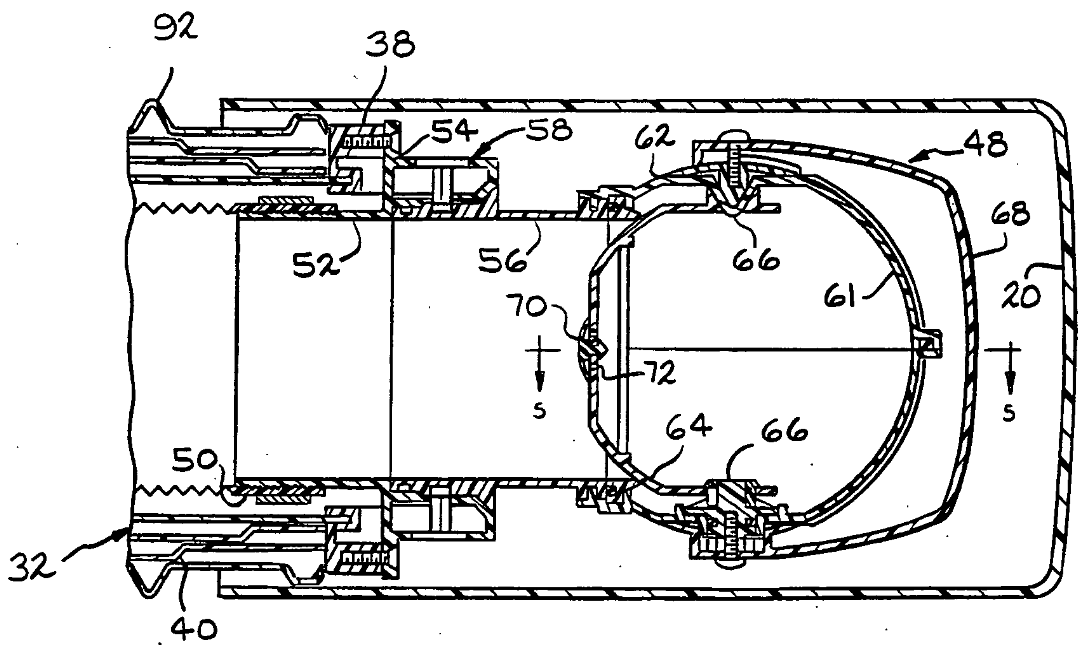
Primary Examiner—A. Michael Chambers
Attorney, Agent, or Firm—Harness, Dickey & Pierce

[57] **ABSTRACT**

A rotatable telescoping drain assembly permanently mounted at the end to waste receptacle drain on the underside of a recreational vehicle consisting of a swivel coupling unit attached to an axially extensible flow hose within a telescoping support tube assembly, a tie rod assembly connected to and extending between the tube assembly and the swivel coupling unit, and a discharge spout unit connected to the other end of the telescoping support tube and flow hose assembly which includes an internal valve. The telescoping tube assembly can be relatively telescoped, the swivel coupling relatively swiveled, and the tie rod relatively pivoted to locate the spout into the inlet of appropriate waste storage facility. During travel of the vehicle the discharge spout and drain assembly is supported within an enclosed cabinet mounted on the vehicle. The telescoping drain assembly allows the vehicle operator to conveniently avoid the usual mess associated with emptying liquid waste receptacles on the vehicle.

10 Claims, 5 Drawing Sheets



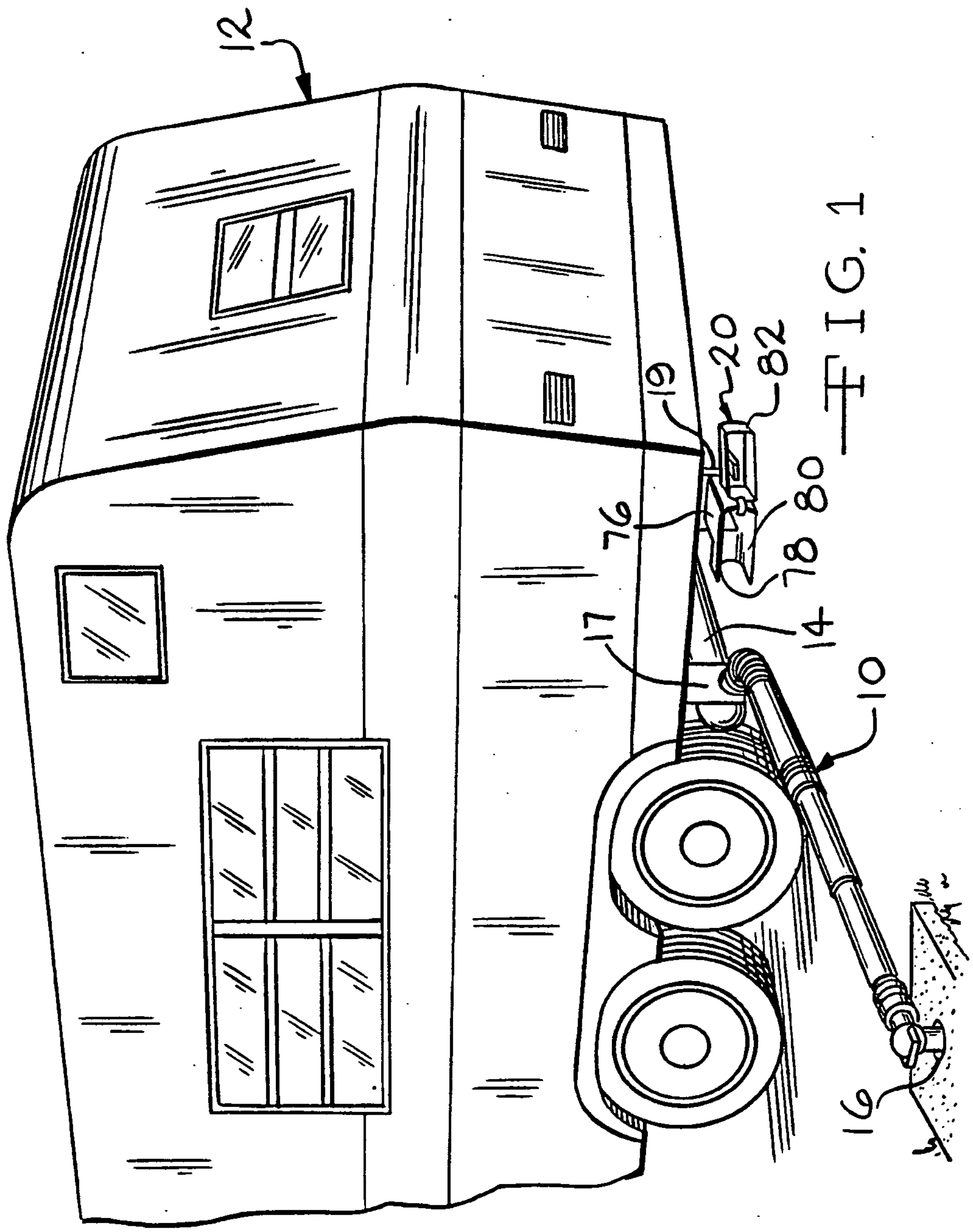
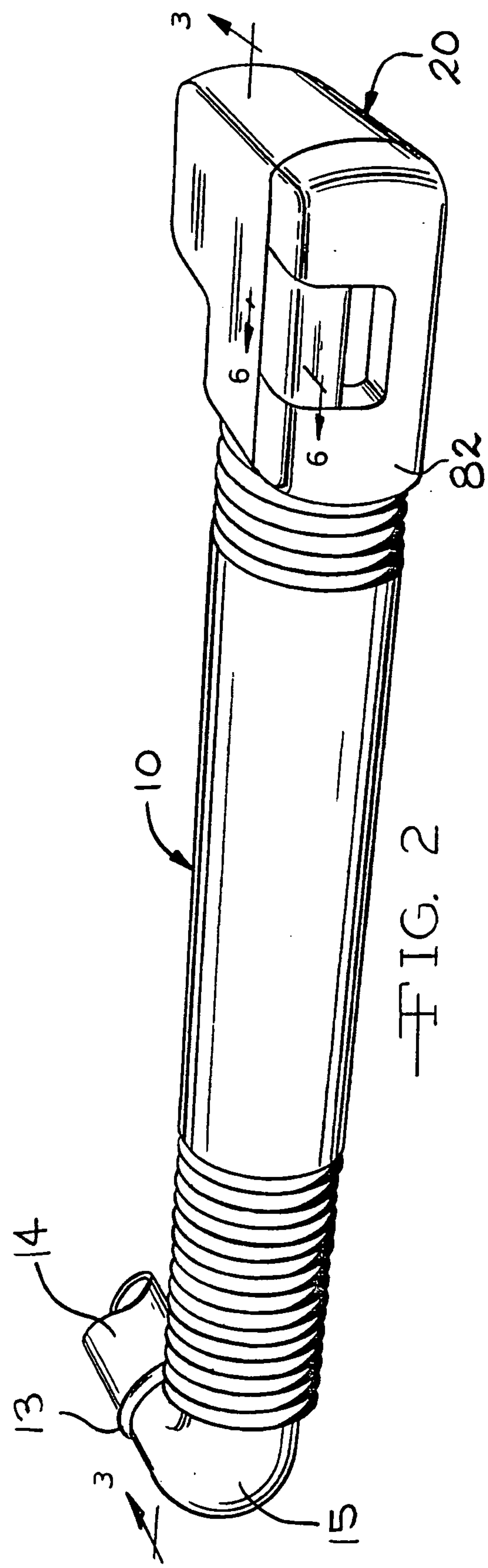


FIG. 1


3
20
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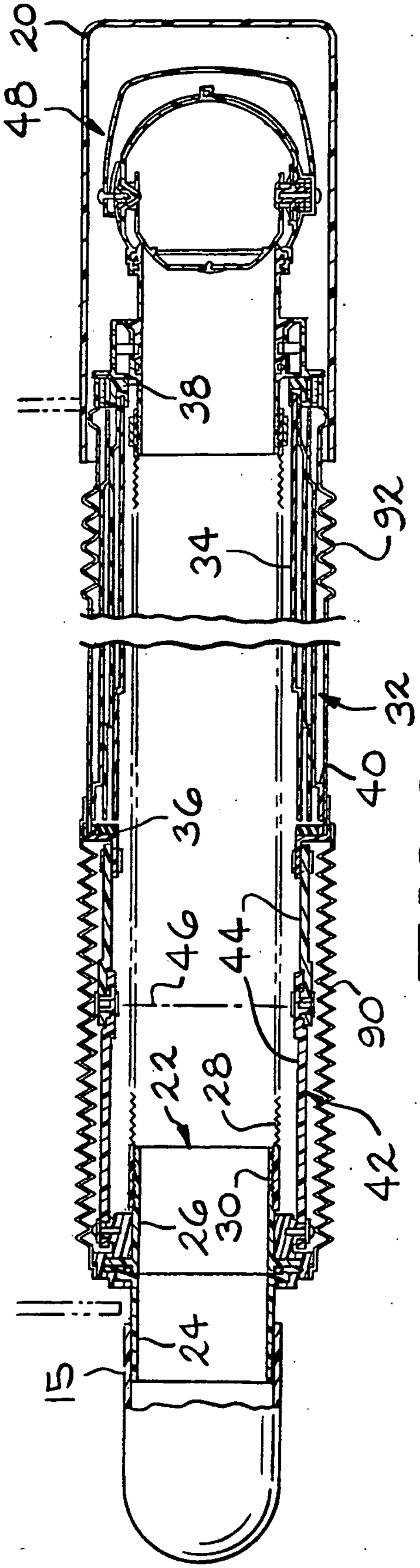
82
10
14
13
3
15

FIG. 2


20
48
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22
28
42
26
30
24
15

FIG. 3

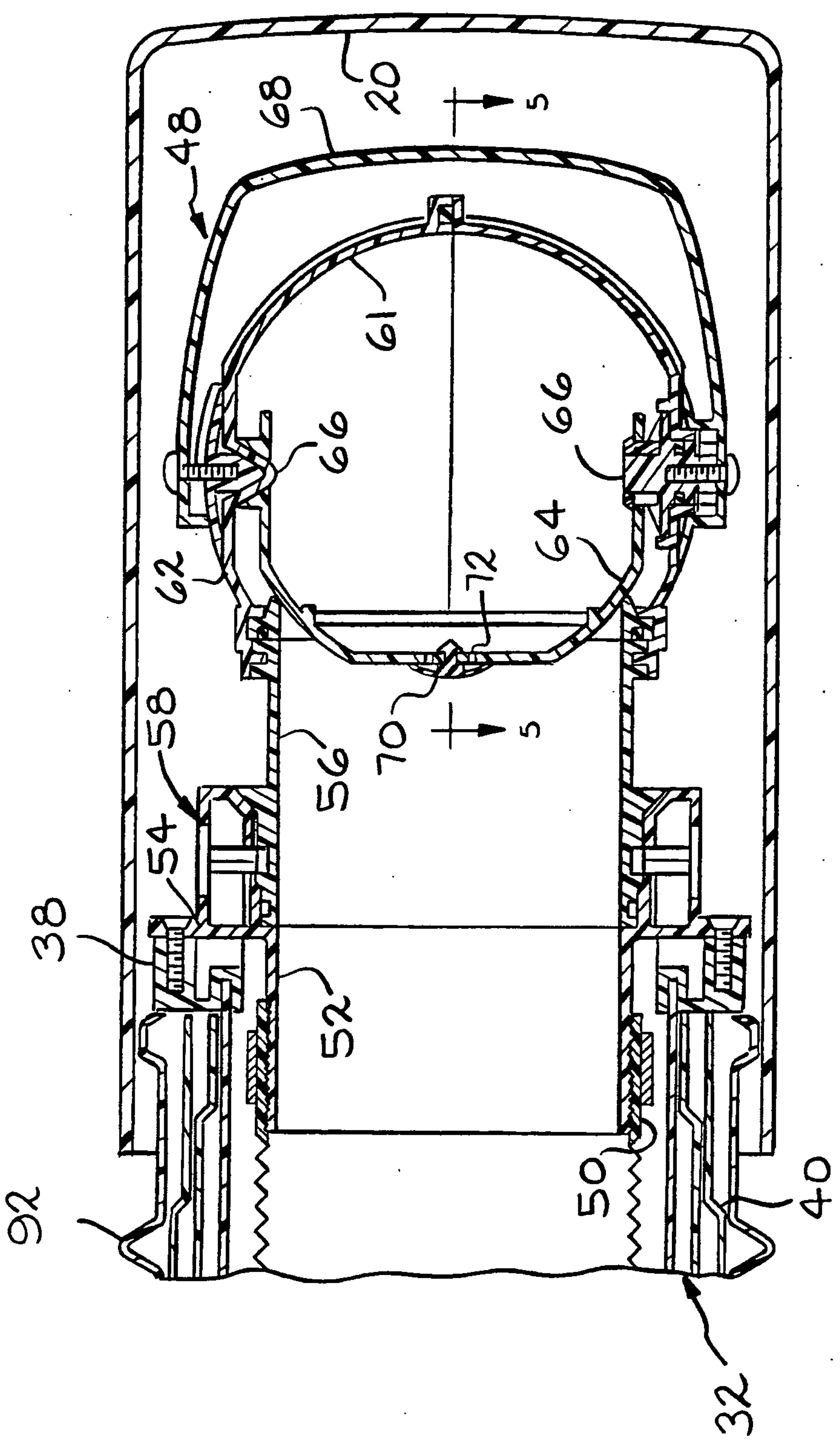

FIG. 4

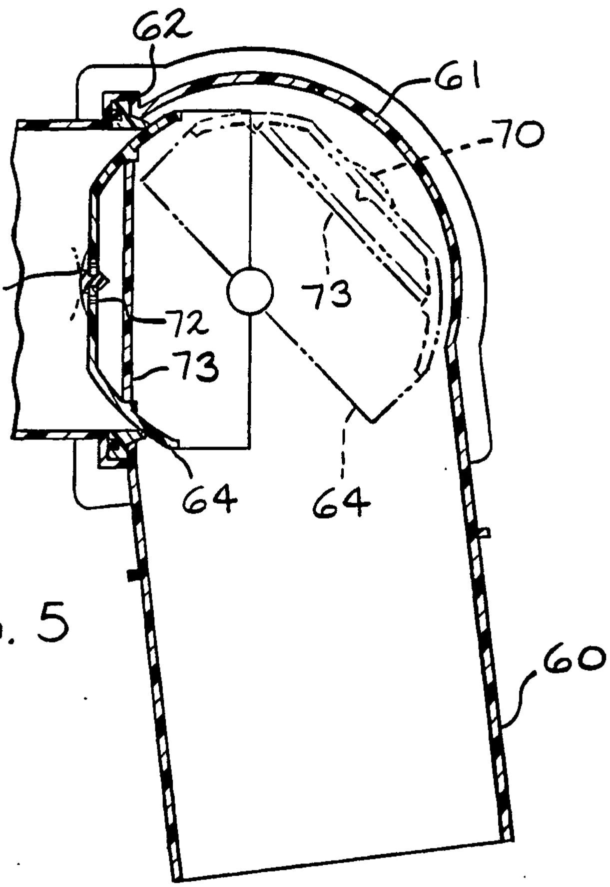

FIG. 5

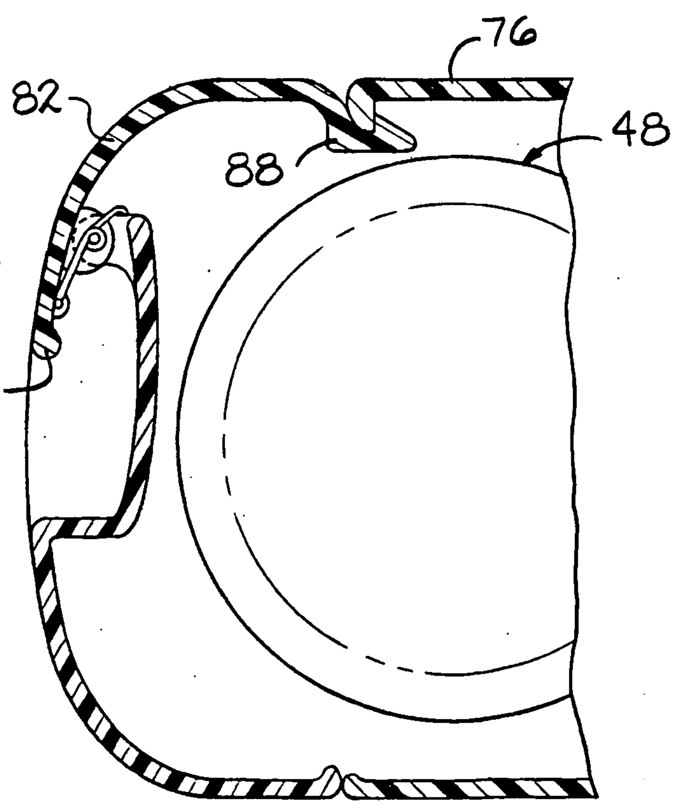

FIG. 6

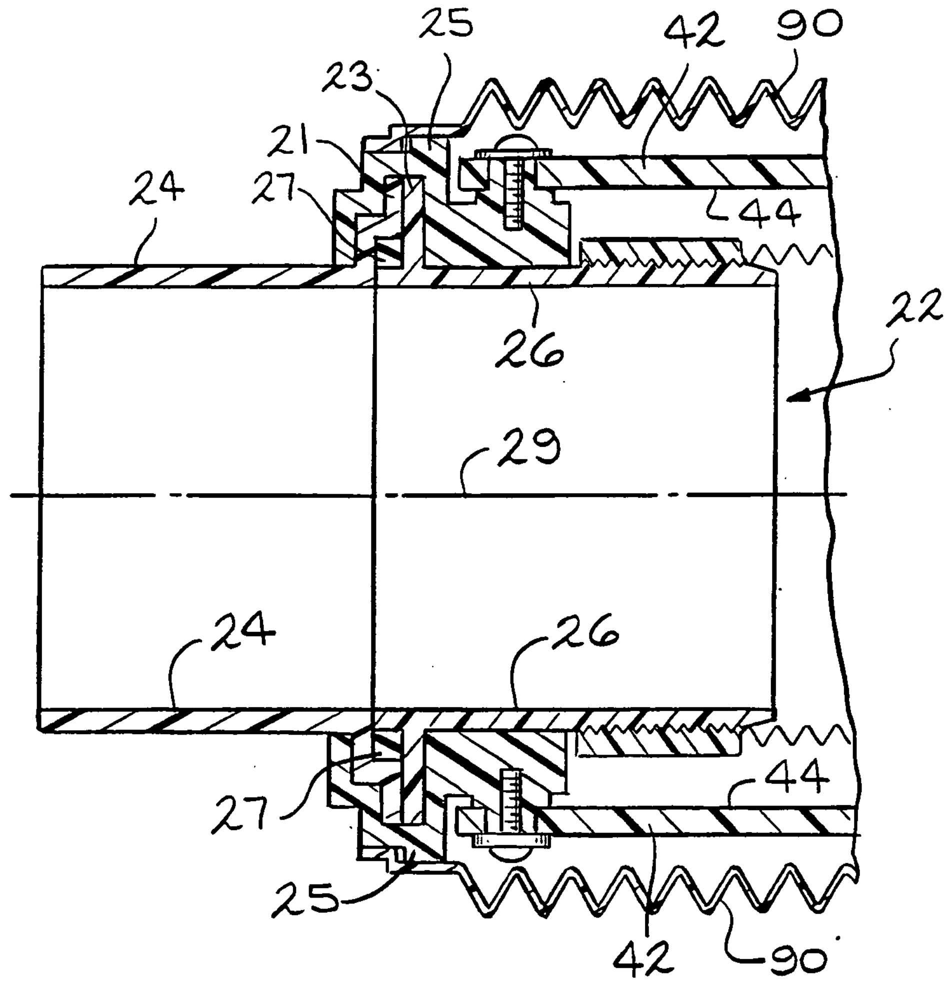

FIG. 7

TELESCOPING DRAIN ASSEMBLY FOR RECREATIONAL VEHICLES

BACKGROUND OF THE INVENTION

This invention relates generally to recreational vehicles and more particularly to a telescoping drain assembly permanently mounted on the vehicle and usable for discharging liquid waste from the vehicle to a suitable storage location such as an underground tank.

Present day recreational vehicles that include collection tanks for waste water and sewage are in wide use. Periodically, such tanks must be emptied. Only rudimentary removal mechanisms are provided for emptying the waste from recreational vehicles. Examples are flexible hoses that are stored in an external cabinet on the vehicle and which must be connected to the discharge pipe on the vehicle and then manipulated to connect to an underground storage tank or the like. These hoses necessarily involve human handling of the waste material both during connection of the hose to the vehicle and in storage of the hose following use to drain the vehicle tanks since some of the waste clings to the hose. In addition, connection or disconnection of the mechanisms often involves crawling around the vehicle on typically soiled pavement near the underground storage tank inlet. As a result, present day systems for removing the stored liquid waste from recreational vehicles are very unsatisfactory.

It is an object of the present invention, therefore, to provide a telescoping drain assembly that enables removal of this waste without the previously unavoidable mess and inconvenience that this entailed for the vehicle operator.

SUMMARY OF THE INVENTION

The present invention consists of a swivel coupling unit comprised of a pair of axially aligned tubes that are relatively rotatable. One of the tubes is connected to the waste water discharge pipe on the vehicle. An axially extensible flow hose of flexible construction is connected at one end to the other one of the tubes. A telescoping support tube assembly having a pair of ends and comprising a plurality of axially telescoped tubes is positioned about the flow hose at a position spaced from the coupling unit so as to protect the flexible flow hose and provide a proper grade for drainage. A tie rod assembly connected to and extending between one end of the tube assembly and the coupling unit comprises tie rod members pivotally connected for pivotal movement about an axis extending transversely through the flow tube.

A discharge spout unit connected to the other end of the telescoping support tube and flow hose assembly includes a valve member moveable between open and closed positions. As a result the telescoping support tube assembly can be relatively telescoped to locate the spout a desired distance from the vehicle and the swivel coupling members can be relatively swiveled and the tie rod members relatively pivoted about the transverse axis to locate the spout at a desired position located to one side of and below the discharge pipe. This enables ready discharge of waste water from the vehicle at any storage tank or the like located in the vicinity of the vehicle. During travel of the vehicle, a cabinet, mounted on the vehicle at a position spaced from the discharge pipe corresponding to the position of the discharge spout in the retracted position of the tube assembly, enables the telescoping drain assembly to be supported in a neat and enclosed manner on the vehicle.

The end result is a telescoping drain assembly that can be readily used by the recreational vehicle operator to dispose of liquid waste from the vehicle in a dignified manner approaching a "white glove" operation. In other words, the vehicle operator can conveniently avoid the usual mess associated with emptying liquid waste receptacles on the vehicle.

Further objects, features and advantages of the invention will be apparent from the accompanying description and the appended claims when taken in connection and the accompanying drawings in which:

FIG. 1 is a fragmentary perspective view illustrating a portion of a recreational vehicle and showing the telescoping drain assembly of this invention is assembly relation with the vehicle and in a position for discharging the liquid waste from the vehicle into an underground receptacle; and

FIG. 2 is a perspective view of the telescoping drain assembly of this invention shown in assembly relation with a vehicle discharge pipe;

FIG. 3 is a longitudinal sectional view of the structure shown in FIG. 2 as viewed from substantially the line 3—3 in FIG. 2; and

FIG. 4 is a fragmentary enlarged sectional view of one end portion of the telescoping drain assembly of this invention;

FIG. 5 is a transverse sectional view of a portion of the telescoping drain assembly that incorporates the discharge spout, as viewed from substantially line 5—5 in FIG. 4, showing the shut off valve in open and closed positions;

FIG. 6 is an enlarged transverse sectional view of a portion of the storage cabinet as viewed from substantially the line 6—6 in FIG. 2; and

FIG. 7 is an enlarged sectional view of the swivel coupling unit shown in FIG. 3.

With reference to the drawing, the telescoping drain assembly of this invention, indicated generally at **10**, is illustrated in FIG. **1** mounted on a recreational vehicle **12** of either van or trailer type containing conventional holding tank(s), not shown, for waste water and sewage and a discharge pipe **14** through which such fluid waste is directed. The telescoping drain assembly **10** is illustrated in FIG. **1** in an operating position in which it is capable of discharging fluid waste from the vehicle **12** into the inlet opening **16** for an underground disposal tank (not shown). The telescoping drain assembly **10** is also moveable to a storage position in which it is of a retracted length relative to the extended length shown in FIG. **1** and in which the discharge end of the drain assembly **10** is supported in a storage cabinet supported on a position below the vehicle **12**. The cabinet **20** is shown in an open position in FIG. **1** and in a closed position shown in FIG. **2**.

The telescoping drain assembly **10** includes a swivel coupling unit **22**, shown sectionally in FIG. **3** and enlarged in FIG. **7**, which is comprised of a pair of relatively rotatable aligned flanged tubular members **24** and **26** and a split ring retainer **25**. Annular flanges **21** and **23** on one end of each of members **24** and **26** respectively are mated together and rotatably enclosed within the annular groove in retainer **25**. Conventional o-ring **27** residing in the recess formed between mated flanges **21** and **23** provides a sealed flow path between tubular members **24** and **26** while allowing relative rotation of

member 26 about axis 29. The opposite end of tubular member 24 is secured to inlet hose 15 which is in turn removably secured to discharge pipe 14 via outlet adapter 13. Inlet hose 15 is secured to the vehicle by bracket 17. The opposite end of tubular member 26 is fixed to end 30 of flow hose 28.

As shown in FIG. 3, the axially extensible flow hose 28 is secured at one end 30 to the tubular member 26. The flow hose 28, in addition to being axially extensible, is of a flexible construction so that it is also readily bendable in a transverse direction.

A telescoping support tube assembly 32, consisting of a plurality of axially aligned relatively telescoped tubes 34 is positioned about the flow hose 28 at a position spaced from the coupling unit 22. In the illustrated embodiment of the invention, the assembly consists of four tubes 34, the outer most tube 34 is secured to an annular bracket 36 and the inner most tube 34 is secured to an annular bracket 38. The ends of the tubes are formed with abutting shoulders 40 so that when the inner most tube 34 is moved in a direction axially away from the adjacent tube 34, when it has been moved its full length, the shoulder 40 thereon will abut with the corresponding shoulder 40 on the adjacent tube so as to in turn extend that tube 40 relative to its outwardly adjacent tube.

Two tie rod assemblies 42 are each pivotally connected to and extended between opposite sides of the retainer 25 as shown in FIG. 7, and the annular bracket 36 shown in FIG. 3. The tie rod assemblies 42 consist of a plurality of link arms 44 that are pivotally connected for relative pivotal movement about an axis 46 which extends transversely through the flow hose 28.

As shown in FIG. 3, a flexibly bendable conduit or accordion bellows tube 90 covers the flow hose 28 and tie rod assemblies 42 and is connected to one end to retainer 25 and at the other end extends over bracket 36 and is connected to the support assembly 32.

A discharge spout unit 48 is connected to the annular bracket 38 at the end of the telescoping tube assembly 32 remote from the coupling unit 22. The end 50 of the flow tube 28 is secured to a tubular member 52 which is in turn provided with an annular flange 54 that is secured to the bracket 38. The discharge spout unit 48 includes an inlet tube 56 which is removably connected by a conventional coupling unit 58 to the flange 54 so that the tubes 52 and 56 are in axial alignment. A tubular spout member 60 that extends at an angle to the tubular member 56 has a ball shaped head portion 61 having an integral coupling unit 62 that rotatably couples the tubular member 56 and spout 60 so that the spout 60 can be manipulated to locate it in a desired opening such as the inlet opening 16 for the underground storage tank. A shut off valve assembly 64 is rotatably mounted on transversely aligned pivot member 66 carried by the ball shaped head portion 61 of spout 60. The shut off valve 64 is moveable between the closed position to seal the end of tube 56 shown in solid lines in FIG. 5 and the open position shown in broken lines in FIG. 5. An external bail member 68 is connected to the shut off valve 64 at the pivot members 66 to provide for movement of the valve 64 between its open and closed positions in response to rotatable movement of the bail 68.

The shut off valve 64 includes a vent valve member 70 which normally covers vent openings such as those indicated at 72. However, in the event of a vacuum condition being created inside the flow tube 28 from the extension of the telescoping drain assembly 10 with shutoff valve 64 in the closed position, the vent valve member 70 will move outwardly, as shown in broken lines in FIG. 5 to enable air to vent through the openings 72. This facilitates a smooth operation of extending the telescoping drain assembly 10. A splash plate 73 prevents the plugging of the vent openings 72 from the splashing of waste flow.

The cabinet 20 is shaped to accommodate the discharge spout assembly 48. The cabinet 20 consists of a main enclosure body 76, of generally L-shape having a side opening 78 and a supporting bottom wall 80 on which the discharge spout assembly 48 rests in a storage position of the telescoping drain assembly 10. The cabinet 20 also includes a door member 82 pivotally mounted by a hinge 84 on the body 76 for movement between an open position to one side of the opening 78 (FIG. 1) and a closed position closing the opening 78 and releasably latched to the body 76 by a latch 88. Cabinet 20 is attached to the substructure of recreational vehicle 12 by means of a support bracket 19.

In the use of the telescoping drain apparatus 10 of this invention, assume that the vehicle 12 is parked and it is desired to empty the liquid waste in the holding tank or tanks in the vehicle 12 through the discharge pipe 14 into the underground tank having the inlet opening 16. Further assume that at such time the assembly 10 is in its storage position shown in FIG. 3 in which it is located below the body of the vehicle 12.

The handle opening 86 (FIG. 6) on the enclosure cover 20 is grasped and the cover 20 is manipulated to release the latch 88 following which the cover 82 is moved to its open position shown in FIG. 1. The discharge spout unit 48 is then manually grasped and moved horizontally out of the enclosure 46 with the vent valve member 70 breaking any vacuum inside flow tube 28 and the spout 60 is rotated to a substantially downwardly extending position. The spout 60 can then readily be moved to a position aligned with the tank opening 16 by virtue of the fact that the telescoping tube assembly 32 enables extension of the drain assembly 10 to a desired length and the bellows 90 along with the tie rod assemblies 42 cooperate with the coupling unit 22 to enable universal movement of the spout 60 both rotatably and pivotably to the necessary position. The bail 68 is then readily moved to position the shut off valve member 64 in its open position shown in broken lines in FIG. 5. Waste material can then flow continuously from the discharge pipe 14 through the discharge spout 60.

When emptying of the liquid waste from the vehicle 12 has been completed, the discharge spout assembly 48 is manually manipulated to return it to its position supported on the bottom wall 78 of the enclosure 76. During such movement, the telescoping tube assembly 32 is retracted to shorten the effective length of the assembly 10 and enable the discharge spout 48 to be readily moved through the enclosure opening 78.

The result is a preconnected and enclosed assembly in which the liquid waste that is being handled is positively prevented from contact with the exterior of the telescoping drain assembly 10 at all times. As a result, the liquid waste can be emptied from the vehicle 12 in a relatively clean operation in which the operator does not have to be concerned with the inconvenient connecting or disconnecting of any waste removal mechanisms, or the unsanitary results of coming in contact with the liquid waste. Such a result is desirable and

advantageous and facilitates desired use of the recreational vehicle 12.

What is claimed is:

1. In combination with a recreational vehicle having a discharge pipe for liquid waste, a telescoping drain assembly which is attached to said vehicle for transporting liquid waste from said discharge pipe to a discharge location spaced from said vehicle, said telescoping drain assembly comprising a swivel coupling unit coupled to said discharge pipe for rotation about an axis in the direction of waste discharge through said coupling unit, an axially extensible flow hose of flexible construction connected at one end to said coupling, an extensible and retractable telescoping tube assembly positioned about said flow hose at a position spaced from said coupling unit, and link means connected to and extending between one end of said tube assembly and said coupling assembly enabling pivotal movement of said tube assembly and said flow hose about an axis extending transversely of said axis through said coupling unit, a discharge spout unit connected to the other end of said flow hose and to the other end of said telescoping tube assembly, whereby telescoping tube assembly can be relatively telescoped to locate said spout a desired distance from said vehicle, and said swivel coupling members can be relatively swiveled about the axis through said coupling unit and said tube assembly pivoted about said transverse axis to locate said spout at a desired position located to one side of and below said discharge pipe.

2. The telescoping drain assembly according to claim 1 further including a cabinet adapted to be mounted on said vehicle at a position spaced from said discharge pipe corresponding to the position of said discharge spout in the retracted position of said tube assembly, said cabinet being usable to enclose said discharge spout unit in a storage position of said telescoping drain assembly in which said telescoping tube assembly is retracted.

3. The telescoping drain assembly according to claim 1 further including a shut off valve member in said discharge spout unit movable between open and closed positions.

4. The telescoping drain assembly according to claim 3 further including an external bail member pivotally mounted on said spout unit and connected to said shut off valve member so that pivotal movement of said bail member is operable to move said valve member between said open and closed positions.

5. The telescoping drain assembly according to claim 3 further including means forming a vent opening in said shut off valve member operable to vent said telescoping drain assembly through said discharge spout to atmosphere when said drain assembly is extended to prevent drawing a vacuum in said assembly which would preclude extension of said assembly.

6. The telescoping drain according to claim 4 further including a splash plate in said shut off valve in front of said vent opening to prevent plugging of said vent opening by the splashing of waste flow toward said opening when said valve is open.

7. In combination with a recreational vehicle having a discharge pipe for liquid waste, a telescoping drain assembly movable between a storage position and an operating position for transporting liquid waste from said discharge pipe to a discharge location spaced from said vehicle, said telescoping drain assembly comprising a swivel coupling unit comprising a pair of relatively rotatable aligned tubular members rotatable about an axis in the direction of waste discharge through said coupling unit, one of which members is connected to said discharge pipe, an axially extensible flow hose of flexible construction connected to one end of the other one of said tubular members, a telescoping tube assembly having a pair of ends and comprising a plurality of axially telescoped tubes positioned about said flow hose at a position spaced from said coupling unit, a tie rod assembly connected to and extending between one end of said tube assembly and said coupling unit, said tie rod assembly comprising tie rod members pivotally connected for pivotal movement about an axis extending transversely through said flow hose at a location spaced from said coupling unit, a discharge spout unit connected to the other end of said telescoping tube assembly, and a valve member in said discharge spout unit movable between open and closed positions, whereby said telescoping tube assembly can be relatively telescoped to locate said spout a desired distance from said vehicle and said swivel coupling members can be relatively swiveled and said tie rod members relatively pivoted about said transverse axis to locate said spout at a desired position located to one side of and below said discharge pipe.

8. The telescoping drain assembly according to claim 7 further including a cabinet adapted to be mounted on said vehicle at a position spaced from said discharge pipe corresponding to the position of said discharge spout in the retracted position of said tube assembly, said cabinet being usable to enclose said discharge spout unit in the storage position of said telescoping drain assembly.

9. The telescoping drain assembly according to claim 8 wherein said cabinet includes a main enclosure body having a side opening and a supporting bottom wall on which said discharge spout can rest, and a door member hingedly mounted on said body for movement between an open position to one side of said side opening and a closed position closing said opening and releasably latched to said body.

10. The telescoping drain assembly according to claim 7 further including a flexibly bendable and longitudinally extensible conduit member enclosing said tie rod assembly and a longitudinally flexible cover member enclosing said telescoping tube assembly.

* * * * *

United States Patent [19]

Rapsilver

[11] **Patent Number: 4,796,926**

[45] **Date of Patent: Jan. 10, 1989**

[54] **DUMP FITTING FOR SEWER HOSE**

[76] Inventor: **Benny L. Rapsilver**, Rt. 4 Box 2640, Nacogdoches, Tex. 75961

[21] Appl. No.: **945,685**

[22] Filed: **Dec. 23, 1986**

[51] Int. Cl.⁴ **F16L 43/00**

[52] U.S. Cl. .... **285/181**; 285/179; 285/253; 4/323; 141/311 R; 141/382; 141/392

[58] Field of Search .... 285/179, 182, 181; 4/321, 323; 138/106; 141/311 R, 382, 383, 384, 385, 386, 392

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4,327,941	5/1982	Schoepe	285/179 X
4,550,452	11/1985	Tufts	4/323 X
4,570,273	2/1986	Antos .	

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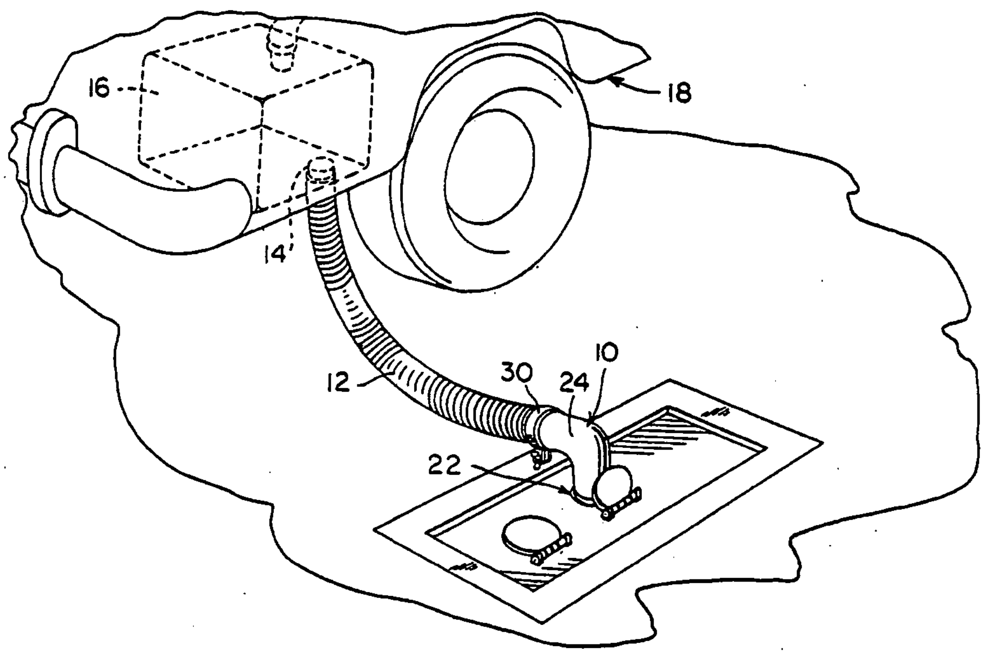
Primary Examiner—Thomas F. Callaghan
Attorney, Agent, or Firm—Fleit, Jacobson, Cohn & Price

[57] **ABSTRACT**

A dump fitting on the discharge end of a sewer hose leading from the waste holding tank of a recreational vehicle prevents the hose from jumping out of a sewer drain under the influence of effluent being discharged through the hose. The fitting is in the form of an elbow with one limb received in the discharge end of the sewer hose and the other limb forming an outlet for receipt in the sewer drain. The fitting is of sufficient weight to resist the thrust of effluent flowing through the hose and tending to lift its discharge end. The fitting may be a one-part plastic molding or a two-part fit-together molding.

2 Claims, 1 Drawing Sheet



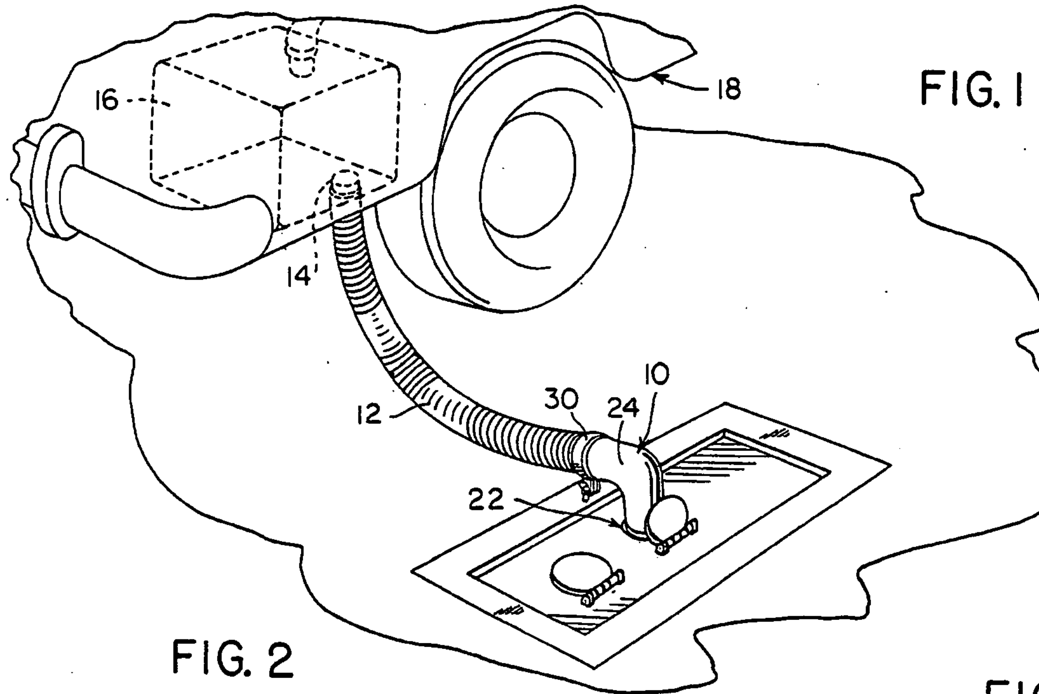


FIG. 1

FIG. 2

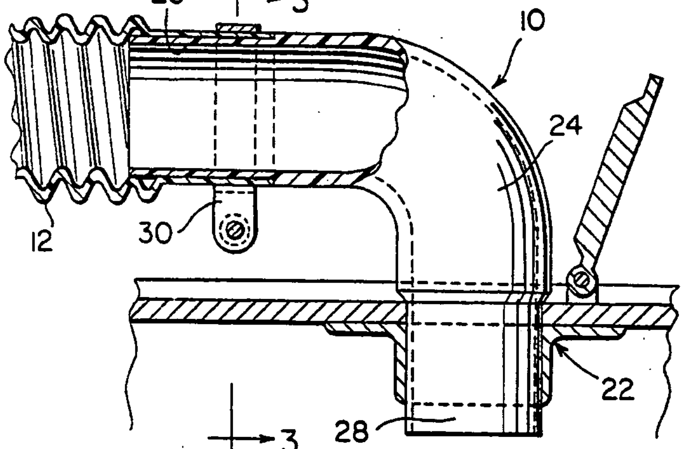
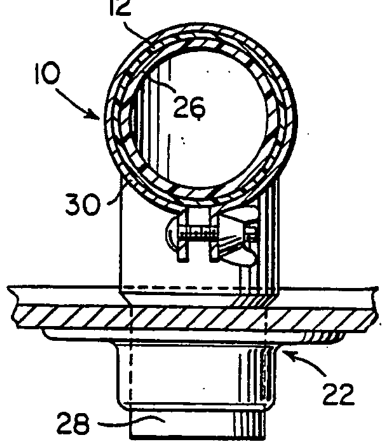


FIG. 3



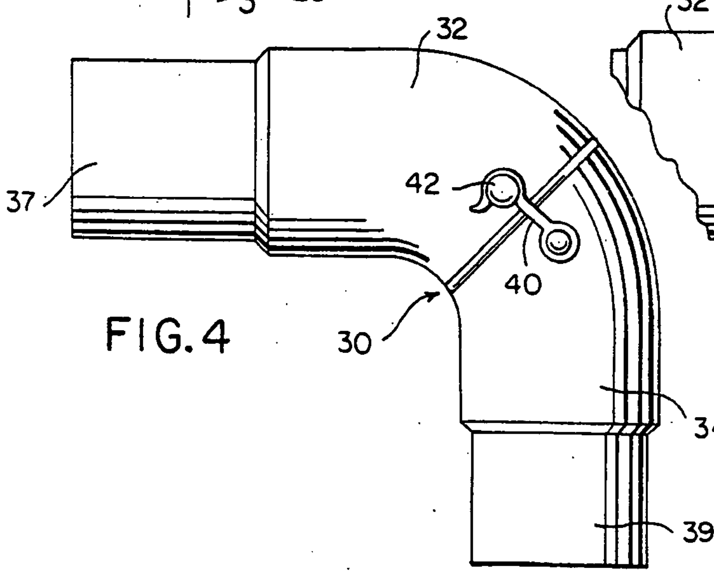
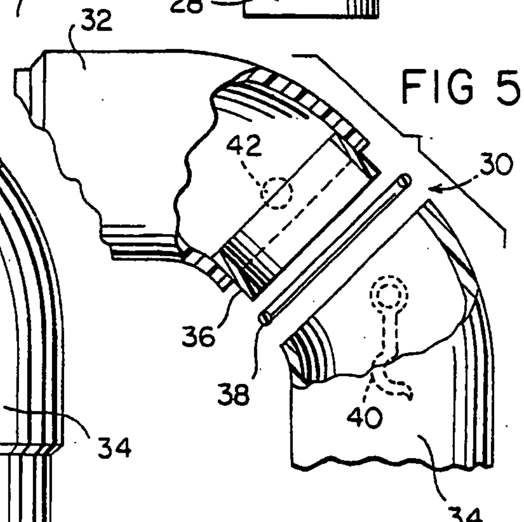


FIG. 4

FIG 5



DUMP FITTING FOR SEWER HOSE

BACKGROUND OF THE INVENTION

This invention in general terms relates to sewer hoses of the type commonly used with recreational vehicles in dumping waste material from a holding tank associated with the vehicle. More particularly, the invention relates to a dump fitting for use on the discharge end of the sewer hose to overcome problems commonly encountered with such equipment.

Recreational vehicles generally are provided with a holding tank for sewage and other waste which is filled while the vehicle is on the road and which is discharged or dumped into a sewer drain, as generally found in camp sites or other vehicle lay-over locations, at the end of a journey. For this purpose, the holding tank is provided with a drain valve that is closed while the vehicle is on the road and which is opened to dump the holding tank through a sewer hose carried on board for connecting the drain valve to the sewer inlet.

Sewer hoses commonly in use with recreational vehicles tend to be of somewhat lightweight construction, for example they may be of wire-reinforced lightweight flexible plastic tubing generally of about 3 inches diameter. Accordingly, dumping of the holding tank at a camp site or like location is generally a 2-person operation, one person to operate the holding tank drain valve and another person to take charge of the discharge end of the hose and ensure it does not jump out of the sewer drain during dumping. If the hose is left unattended, the discharge end may tend to jump out of the drain when the flow of effluent is initiated due to the thrust of the effluent overcoming the lightweight construction of the hose. The effects of a sewer hose jumping out of the drain during effluent discharge through the hose are self-evident.

It is an object of the present invention to provide a hold-down fitting for the discharge end of a sewer hose of the type described which will prevent the hose from jumping out of the sewer drain or like fitting during effluent discharge, thereby enabling a recreational vehicle holding tank to be drained by a single operator manipulating the tank drain valve without the need for another person to guard the hose outlet.

Applicant is aware of the following U.S. patents relating to sewer hoses and like fittings. None of these patents, however, discloses a device having the features of the present invention:

U.S. Pat. Nos. 1,846,500—Feb. 23, 1932
3,334,821—Aug. 8, 1967
3,633,219—Aug. 20, 1970
3,730,228—May 1, 1973
4,327,941—May 4, 1982
4,570,273—Feb. 18, 1986

SUMMARY OF THE INVENTION

The invention provides a dump fitting for use on the discharge end of the sewer hose of a recreational vehicle to prevent the hose from jumping out of a sewer or like drain under the influence of effluent being discharged through the hose, the fitting being in the form of an elbow having one limb for receipt in the discharge end of the hose and another limb forming an outlet for receipt in the sewer or like drain, the fitting being of sufficient weight to resist the thrust of effluent flowing through the hose and tending to lift its discharge end. For example, for a standard 3-inch wire-reinforced lightweight plastic hose, the weight of the fitting preferably should be at least about 1¼ to 2 lbs.

The dump fitting may, for example, be molded in a hard plastic material such as PVC or ABS plastic and the one limb may be secured in the hose outlet with a surrounding hose clip. The fitting may comprise an integral 1-piece molding, or it may be molded as a pair of fit-together parts which connect at the point of the elbow and which have an interposed O-ring seal, and external clip or hook devices for releasably holding the parts together. The 2-part fitting may be useful, for example, for recreational vehicles in which the sewer hose is stored when not in use, in a rectangular section bumper which could not accommodate a 1-piece elbow fitting.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a part of a recreational vehicle including an effluent holding tank, a sewer hose for draining the holding tank, and a sewer drain into which the tank discharges, wherein the hose has a dump fitting in accordance with the invention at its discharge end.

FIG. 2 is an enlarged elevational view, partly in section, of the discharge end of the hose, the dump fitting, and the sewer drain inlet.

FIG. 3 is a sectional view on line 3—3 of FIG. 2.

FIG. 4 is an elevational view of a modified form of dump fitting.

FIG. 5 is an exploded view, partly in section, of the modified fitting.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring initially to FIGS. 1–3, there is illustrated a first embodiment dump fitting **10** in accordance with the invention attached to the outlet end of a conventional sewer hose **12** coming from a drain valve-controlled outlet **14** of the holding tank **16** in recreational vehicle **18**. The holding tank, the drain valve (which is not shown) and the sewer hose may all be of well known form and construction for discharge of effluent from the holding tank, for example, into a sewer drain **22** at a camp site or like location. The construction of the sewer drain may vary from site to site and does not form part of the invention. The sewer hose may be of the attachable-detachable type and may be a lightweight wire-reinforced plastic tube.

Fitting **10** may he molded in a hard plastic material, as aforesaid, with a body portion **24** in the form of a 90° elbow and with spigoted ends **26, 28**. One end **26** of the fitting is sized to fit in the discharge end of hose **12**. A known form of stainless steel hose clip **30** is provided to hold the fitting in place. In use, for dumping tank **16**, the other end **28** of the fitting is placed in the sewer drain.

The overall weight of fitting **10** is such as to prevent the thrust created by effluent flowing through hose **12** from causing the fitting to jump out of drain **22** when the holding tank drain valve is opened. Thus, for example, for a 3-inch lightweight hose, the weight of fitting **10** should preferably be at least about 1¼ to 2 lbs. Use of

the fitting accordingly enables the holding tank to be drained by a single operator working the drain valve without having to have another person guard the hose outlet.

FIGS. 4 and 5 show a 2-piece fitting 30 equivalent to fitting 10 but useful, for example, in vehicles where the sewer hose is stored in a confined area which could not accommodate the complete elbow fitting. Accordingly, fitting 30 has a pair of body sections 32, 34 which connect together to form an elbow with a spigot section 36 and an O-ring seal 38 therebetween. The fitting has spigoted ends 37, 39 equivalent to ends 26, 28 of fitting 10. To releasably hold the sections 32, 34 together, pivotal eye hooks 40 and keepers 42 may be provided on opposite sides of respective sections. It is understood that the size and general weight characteristics of fitting 30 should be similar to those of fitting 10, and that the fittings are used in the same way.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. In combination with a flexible sewer hose for discharging effluent from a holding tank of a recreational vehicle, a rigid dump fitting in the form of a tubular elbow connected to a discharge end of the hose, the dump fitting having an outlet for close fitting telescopic insertion in a sewer drain to enable flow of effluent from the hose into the sewer drain without interruption and being of a weight sufficient for preventing the discharge end of the hose from jumping out of the drain under the influence of thrust created by effluent flowing through the hose, said dump fitting having an inlet limb telescopicallv inserted in the discharge end of the sewer hose and hold in place by a hose clamp encircling the hose, and an outlet limb telescopically inserted into the sewer drain in close fitting relation with both limbs being rigid and provided with a spigoted end portion, said fitting being a two-piece molding of hard plastic comprising first and second sections and means for releasably connecting the sections substantially along a mid-plane of the elbow, said connecting means comprising a spigot element on one section telescoped into the other section, an O-ring seal carried on the spigot element and external interengageable latch elements on the respective sections, said latch elements including eye hooks pivotally mounted on one of the sections and eye hook keepers in the form of headed projections on the other section.

2. The invention of claim 1 wherein the sewer hose is a 3" diameter wire reinforced lightweight plastic tube and the dump fitting weights at least about $1\frac{1}{2}$ to 2 pounds.

* * * * *

United States Patent [19]

Foreman

[11] **Patent Number: 4,854,349**

[45] **Date of Patent: Aug. 8, 1989**

[54] **SEWAGE DRAINING DEVICE FOR RECREATIONAL VEHICLES OR THE LIKE**

[76] Inventor: **Dennis Foreman**, R.R. 3, Box 15, Fairland, Ind. 46126

[21] Appl. No.: **43,329**

[22] Filed: **Apr. 28, 1987**

[51] **Int. Cl.⁴** **F16K 27/12**

[52] **U.S. Cl.** **138/89**; 137/899; 137/355.16; 138/107; 138/119; 285/62; 285/402; 285/901

[58] **Field of Search** 4/321; 138/89, 103, 138/107, 109, 114, 121, 119; 248/49, 58, 60; 137/351, 354, 355.19, 899; 285/7, 45, 62, 396, 402, 235, 236, 961

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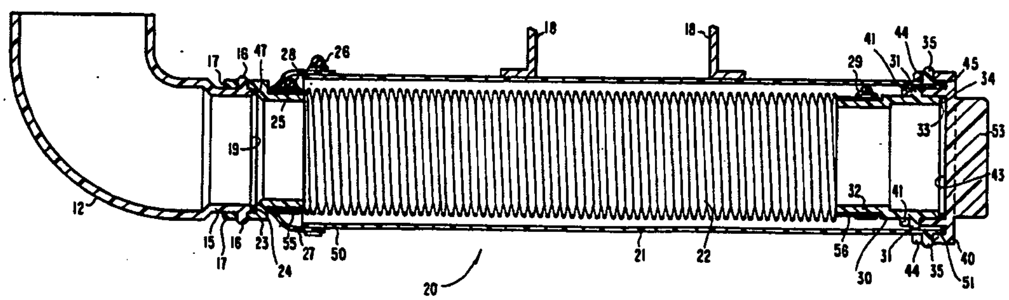
Primary Examiner—William A. Cuchlinski, Jr.
Attorney, Agent, or Firm—Woodard, Emhardt, Naughton Moriarty & McNett

[57] **ABSTRACT**

A sewage draining device having a drain coupling, an independently suspended tubular housing, a flexible, extendable drain hose and a dual closure cap. In storage, the hose is fully retracted within the housing with the dual closure cap closing both the hose and the housing. For drainage, the dual closure cap is disengaged from the housing and the cap/hose combination may then be extended from the housing to a sewage receiving tank. The dual closure cap is then removed from the hose for drainage. The drain coupling and the housing, while connected to each other to complete the closure of the hose in storage, are independently suspended from the vehicle, whereby the device will withstand transportation without incurring damage or causing damage to the vehicle.

2 Claims, 1 Drawing Sheet



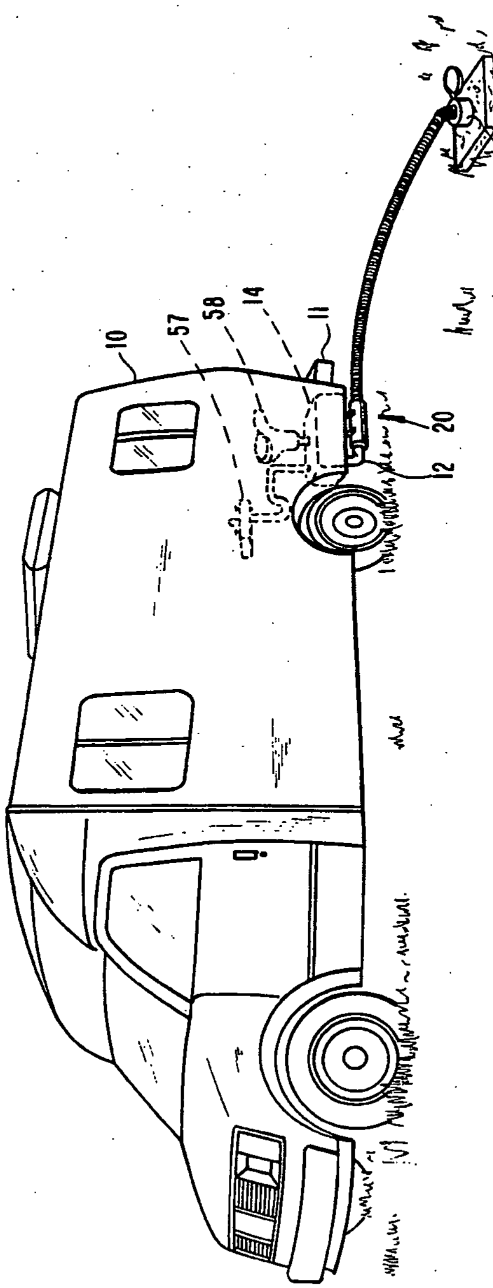


Fig.1

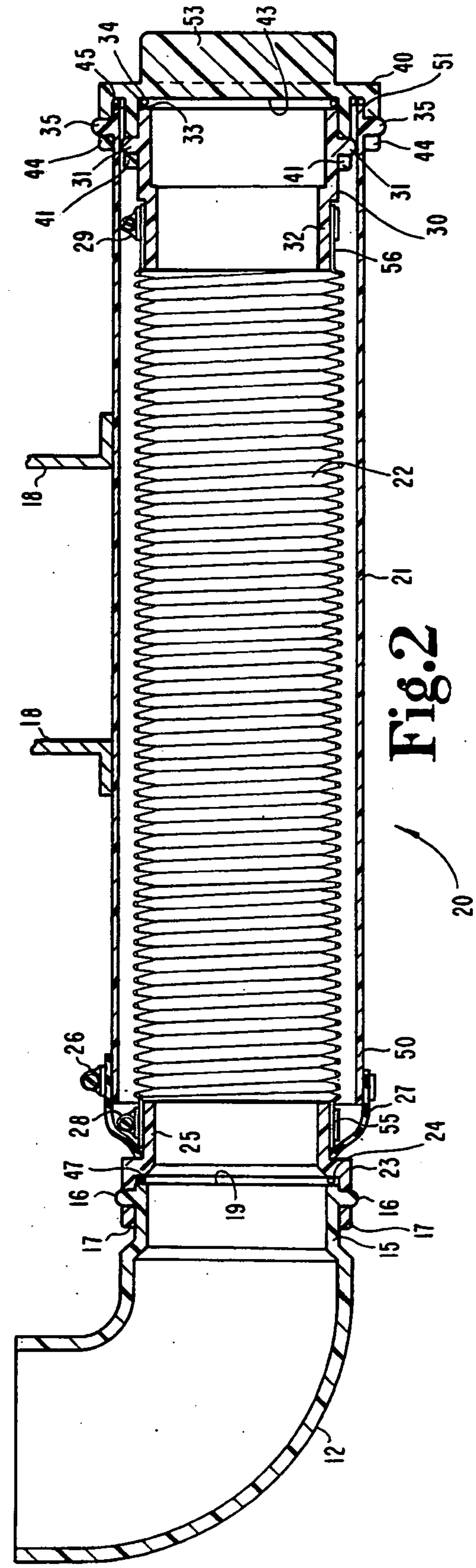


Fig.2

SEWAGE DRAINING DEVICE FOR RECREATIONAL VEHICLES OR THE LIKE

FIELD OF THE INVENTION

The present invention relates to the field of sewage draining devices, and more particularly to a sewage draining device for recreational vehicles or the like.

BACKGROUND OF THE INVENTION

The enjoyment of outdoor living and of traveling by road to see the country have contributed to the popularity of recreational vehicles (RVs) in our society. Along with the benefits and enjoyment of RV living, however, come certain unpleasant maintenance jobs, such as emptying and cleaning the vehicle's sewage system.

Present RV sewage systems often include a flexible drain hose which is stored in a hollow receiving area within the bumper of the vehicle. The hose must be taken out and connected at one end to a fitting on or in communication with the vehicle's holding tank. The opposite end of the hose is then extended to an appropriate sewage receiving facility. After drainage is complete, the hose is detached from the tank, rinsed out, coiled up or retracted, and stored until the next use. Each time the tank is to be drained, the entire hose must be removed from the bumper, attached, maneuvered to the receiving tank, detached, cleaned and re-stored back in the bumper. The inherent awkwardness of handling these ten or twenty foot flexible drain hoses makes this maintenance task particularly difficult and unpleasant. What is needed is a sewage draining device which is inexpensive, easy to handle, easy to clean, easy to manipulate and easy to store.

SUMMARY OF THE INVENTION

Generally speaking, there is provided a self-contained sewage drainage unit requiring no connections or awkward manipulations and only minimal handling. According to one embodiment, a sewage draining device has a drain coupling, an independently suspended tubular housing, a flexible, extendable drain hose and a dual closure cap. In storage, the hose is fully retracted within the housing with the dual closure cap closing both the hose and the housing. For drainage, the dual closure cap is disengaged from the housing and the cap-hose combination may then be extended from the housing to a sewage receiving tank. The dual closure cap is then removed from the hose for drainage. The drain coupling and the housing, while connected to each other to complete the closure of the hose during storage, are independently suspended from the vehicle, whereby the device will withstand transportation without incurring damage or causing damage to the vehicle.

It is an object of the present invention to provide a sewage drain device which is easy to use with minimal risk of soiling to the user.

It is another object of the present invention to provide a sewage drain device which is conveniently placed and stored compactly.

It is a further object of the present invention to provide such a device that will store during travel without incurring damage or causing damage to the vehicle.

Further objects and advantages of the present invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the sewage draining device in use with a recreational vehicle in accordance with one embodiment of the present invention.

FIG. 2 is a side, cross-sectional view of the sewage draining device of FIG. 1 in a stored and sealed condition.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now to FIG. 1, there is shown a sewage draining device 20 adapted for use with a recreational vehicle 10 in accordance with one embodiment of the present invention. In conventional systems, a ten or twenty foot length (extended) of flexible drainage hose would often be stored in a special hollow bumper 11 proximal to the holding tank outlet coupling 12. The entire hose would be removed from bumper 11, connected at one end to outlet coupling 12 and the other end would be inserted into the sewage receptacle 13.

As shown in FIG. 2, draining device 20 includes a cylindrical housing 21, an extendible, accordian-type sewer hose 22, drain coupling 23, damping connector 27, termination filling 30 and dual closure cap 40. Outlet coupling 12 is in direct communication with a sewage holding tank 14 of RV 10. Outlet coupling 12 is elbowed to provide a horizontally, rearwardly extending portion 15 to receive drain coupling 23. Although draining device 20 is fixedly secured to RV 10 by a pair of brackets 18, a bayonet-coupling relationship is provided between portion 15 and drain coupling 23 to facilitate replacement or repair of draining device 20. Comprising a first bayonet assembly is rearwardly extending portion 15 which has at least two radially spaced, outwardly extending bayonet pins 16 which mate with forwardly extending bayonet hooks 17 of drain coupling 23. To provide a tight sealing relationship between draining device 20 and outlet coupling 12, the outside diameter of portion 15 is approximately identical to the inside diameter of drain coupling 23. Additionally, an O-ring 47 is fixed in an appropriate manner such as gluing to interior annular ledge 24 of drain coupling 23. A flat annular surface 19, defined by the end of portion 15, is compressively received adjacent O-ring 47 upon engagement and tightening of the bayonet assembly, forming a liquid-tight seal therewith.

Due to the high frequency and magnitude of vibrations and bumps imposed by the road upon the RV, relative forces among the holding tank 14, sewage draining device 20 and other related elements within RV 10 (due primarily to their location at the rear of the RV) can damage the draining device. A shock-absorbing damping connector 27 is provided between housing 21 and drain coupling 23 to reduce the risk of damage. Damping connector 27 is made of a tubular, resilient material such as rubber and is attached at one end in

tight, encircling engagement to the neck 25 of drain coupling 23. At its other end, damping connector 27 is likewise attached in tight, encircling engagement with the forward end 50 of housing 21. Damping connector 27 may be fixed to neck 25 and housing 21 by any means suitable to contain odors or leaking waste. In the preferred embodiment, damping connector 27 is shrink fit to neck 25 and secured to housing 21 by clamp 26. This allows easy replacement of damaged or faulty subparts of device 20.

The outer diameter of neck 25 is sufficiently smaller than the inside diameter of housing 21 to allow one end 55 of sewer hose 22 to encircle neck 25 within housing 21. End 55 of sewer hose 22 is sized to fit snugly around neck 25 and is held thereagainst by appropriate fluid-tight sealing means. In the present embodiment, hose clamp 28 holds end 55 of hose 22 tightly around neck 25.

Housing 21 is long enough to receive the entire length of hose 22 in its retracted position, plus several more inches to receive the various couplings and fittings. Housing 21 is suspendedly secured to the underside of RV 10 by a pair of suitable brackets 18. The attachment of brackets 18 to RV 10 or to housing 21 is detachable to permit replacement or repair of draining device 20.

Sewer hose 22 is received at its opposite end 56, in liquid-tight engagement, around neck 32 of termination fitting 30. In the present embodiment, hose clamp 29 holds end 56 tightly around neck 32. Hose 22, neck 25 of drain coupling 23 and termination fitting 30 are each sized to fit freely within housing 21.

Dual closure cap 40 serves a dual function using a bayonet system of sealing to close off both termination fitting 30 and housing 21. Forwardly extending, interior bayonet hooks 41 of cap 40 are ramped and sized to lockingly engage with radially extending bayonet pins 31 of termination fitting 30. Flat annular surface 33, defined by the rearward termination of fitting 30, forms a seal with O-ring 34, which is fixedly disposed against flat inner wall 43 of cap 40. Engagement and tightening of hooks 41 with pins 31 compresses O-ring 34 between annular surface 33 and inner wall 43 forming a liquid tight seal.

Similar forwardly extending, exterior bayonet hooks 44 of cap 40 and radially extending bayonet pins 35 of housing 21 hold cap 40 locked in a liquid-tight, closing position onto rearward end 51 of housing 21. O-ring 45 is disposed between end 51 and cap 40 to provide a liquid-tight seal. It may be desirable to omit O-ring 45 to leave a small air gap between cap 40 and housing 21 to permit evaporation of residual moisture within housing 21. A flat, rearwardly extending handle 53 is provided for grasping cap 40.

Use of the sewage draining device would be as follows:

With the sewage receptacle 13 within the maximum reach of extendable sewer hose 22, cap 40 is twisted (preferably counter-clockwise) by handle 53, thus disengaging exterior bayonet hooks 44 from exterior bayonet pins 35. Cap 40 may then be pulled away from housing 21. Due to the smaller, relative diameters of termination fitting 30 and sewer hose 22 within housing 21, rotation of cap 40 will only cause disengagement of cap 40 from housing 21 and will not disengage cap 40 from termination fitting 30. With cap 40 still attached to fitting 30, sewer hose 22 is withdrawn from housing 21 by pulling cap 40 over to sewage receptacle 13. Cap 40 is then removed from termination fitting 30 by grasping fitting 30 with one hand and twisting cap 40 off with the other. Fitting 30 is then inserted down into receptacle 13 for drainage. After drainage is complete, washwater or the like or special rinsing liquids can be poured or released from sink 57 or toilet 58 within RV 10 to rinse holding tank 14 and hose 22. The process is then reversed to restore and seal, in the storage position, sewer hose 22 with only minimal or no touching or handling of hose 22. If desired, immediately following drainage, a disinfecting chemical can be poured into the system, settling in the sealed hose. The user is thus exposed to the odors of the drainage hose only during actual removal of and application of end cap 40 to termination fitting 30.

Although the invention has been described for use with recreational vehicles, it is adaptable for any vehicular sewage draining application. Other examples where the present invention would be appropriate are trains, planes, boats, buses, vans and semi-trailer cabs.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

What is claimed is:

1. A sewage draining device for use with a vehicle having an outlet coupling for the exit of sewage from within the vehicle, comprising:

a flexible, extendable sewer hose;

first coupling means for providing permanent fluid-tight relation between a first end of said hose and the outlet coupling;

a tubular housing suspended from said vehicle and fixed at a first end to said first coupling means;

a dual closure cap for sealing shut both said hose and said housing, whether said cap has second coupling means for connecting said cap in fluid-tight closing relation to the second end of said hose and has third coupling means, exterior of said second coupling means, for connecting said cap in closing relation with the second end of said housing;

wherein said second coupling means includes a second fitting connected to the second end of said hose, wherein said second coupling means includes first bayonet means extending from said fitting and from said cap for lockingly engaging and drawing said cap in fluid-tight, closing relation with said second fitting, and wherein said second coupling means further includes an O-ring disposed between the end of said second fitting and said cap and wherein said first bayonet means is sized to create fluid-tight sealing among said second fitting, said O-ring and said cap when the device is in a storage position;

wherein said third coupling means includes second bayonet means extending from the second end of said housing and from said cap for lockingly engaging and drawing said cap in closing relation with said housing; and,

wherein said draining device has first and second positions, said first position being a storage position characterized by said hose being fully retracted within said housing and said dual closure cap removably coupled in fluid-tight, closing relation to a

second end of said hose and coupled in closing relation to a second end of said housing, said second position being a drainage position characterized by said hose being substantially extended exterior of said housing with said dual closure cap being disengaged from said housing.

2. A sewage draining device for use with a vehicle having an outlet coupling for the exit of sewage from within the vehicle, comprising:

a flexible, extendable sewer hose;

first coupling means for providing permanent fluid-tight relation between a first end of said hose and the outlet coupling;

a tubular housing suspended from said vehicle and fixed at a first end to said first coupling means,

a dual closure cap for sealing shut both said hose and said housing, wherein said cap has second coupling means for connecting said cap in fluid-tight closing relation to the second end of said hose and has third coupling means, exterior of said second coupling means, for connecting said cap in closing relation with the second end of said housing;

wherein said first coupling means includes a first fitting connected to the first end of said hose, wherein said first coupling means includes first bayonet means extending from said fitting and from the outlet coupling for lockingly engaging and drawing said first fitting in fluid-tight, closing relation with said outlet coupling, and wherein said first coupling means further includes an O-ring disposed between said fitting and said outlet coupling and wherein said first bayonet means is sized to create fluid-tight seal among said fitting, said O-ring and said outlet coupling; and,

wherein said draining device has first and second positions, said first position being a storage position characterized by said hose being fully retracted within said housing and said dual closure cap being removably coupled in fluid-tight, closing relation to a second end of said hose and coupled in closing relation to a second end of said housing, said second position being a drainage position characterized by said hose being substantially extended exterior of said housing with said dual closure cap being disengaged from said housing.

* * * * *

United States Patent [19]

Mercer

[11] **Patent Number: 5,023,959**

[45] **Date of Patent: Jun. 18, 1991**

[54] **EXTENDABLE WASTE HOSE SYSTEM**

[75] Inventor: Albert E. Mercer, Jacumba, Calif.

[73] Assignee: **Thetford Corporation,** Ann Arbor, Mich.

[21] Appl. No.: **331,965**

[22] Filed: **Apr. 3, 1989**

[51] **Int. Cl.**[5] **E03D 1/00**

[52] **U.S. Cl.** .... **4/321;** 4/323; 4/661; 137/355.16; 137/355.2; 137/899; 138/109; 138/121; 242/86.5 R

[58] **Field of Search** 4/323, 661, 321; 138/106, 109, 89, 103, 121; 137/355.16, 355.2, 355.21, 899; 242/86.2, 86.5; 15/315

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Attorney, Agent, or Firm—Harness, Dickey & Pierce

[57] **ABSTRACT**

A systen for extending and retracting the waste hose for a waste disposal system that is typically found on recreational vehicles and includes power or crank-driven hose extender means for extending the collapsible hose from its collapsed mode stored on-board the recreational vehicle, to its extended configuration which it is used for dumping waste from an RV holding tank into an inlet of an RV waste dump station. The system includes a specialized hose extension and retraction mechanism, and a universal coupling at the end of the hose which will fit waste station inlet pipes of all the commonly used sizes, which run from 3" to 4½" in diameter. In addition, a special structure is used to create a 90 degree bend in the outboard end of the hose, and an optional unidirectional cuff around the hose will hold tension on the hose so it can be stretched between the recreational vehicle and the inlet, but will permit the hose to be manually pushed back through the cuff without substantial resistance.

17 Claims, 3 Drawing Sheets

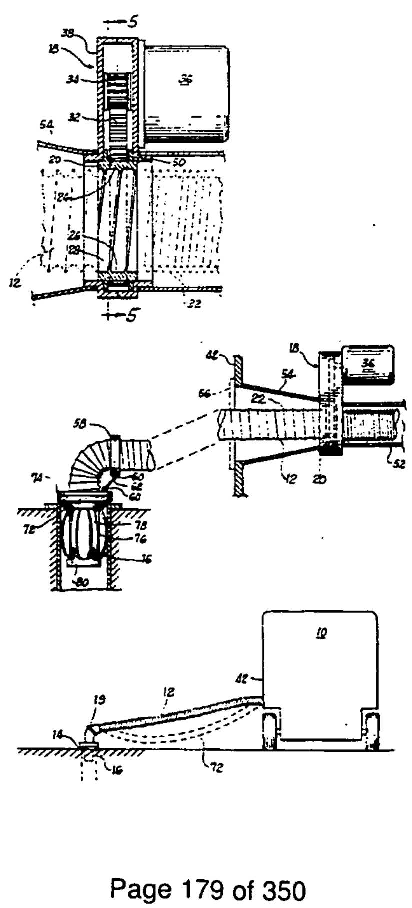


FIG. 1

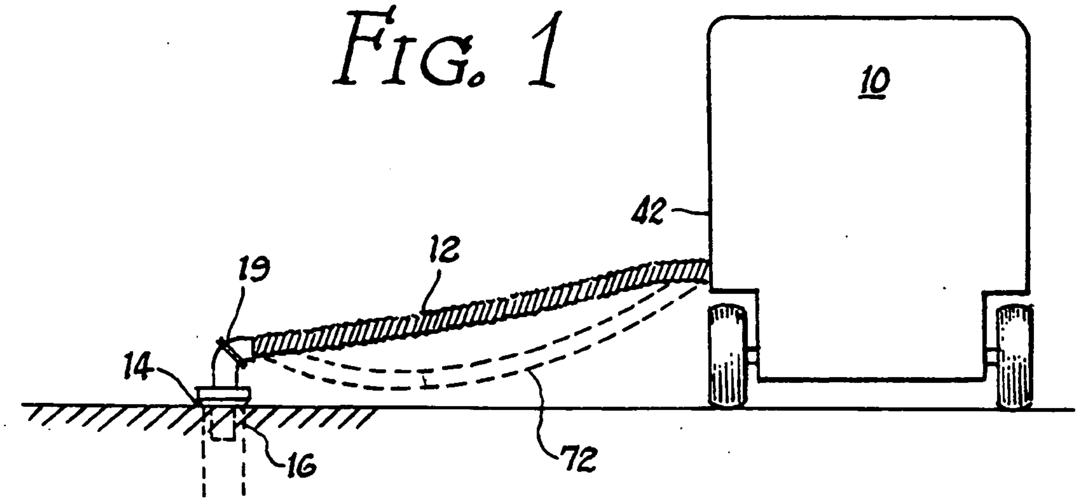


FIG. 2

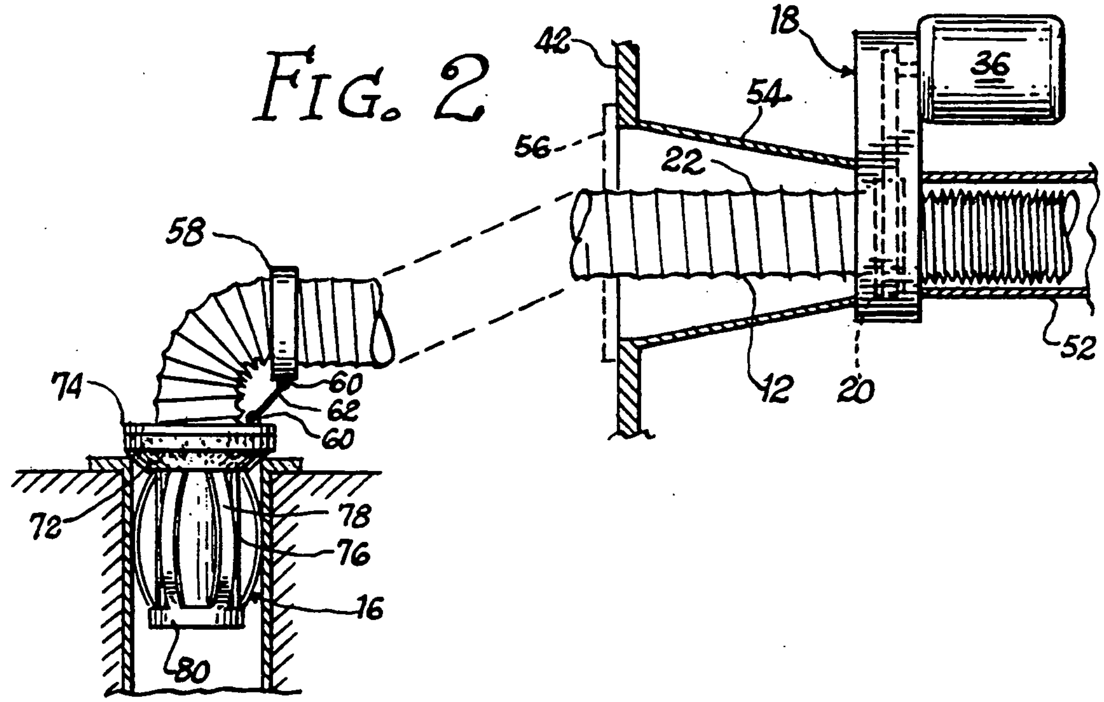


FIG. 3

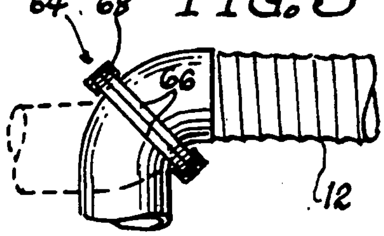


FIG. 4

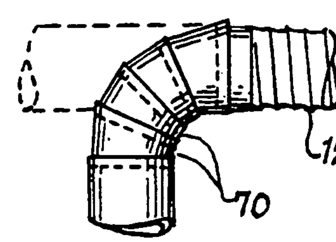


FIG. 5

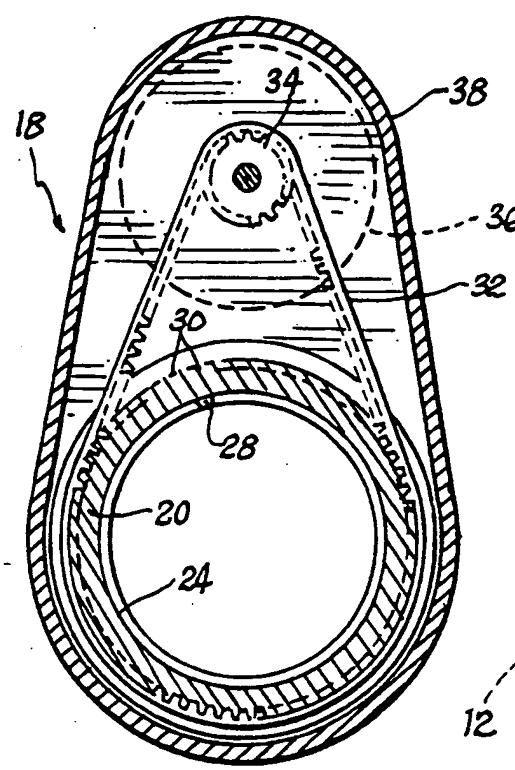


FIG. 6

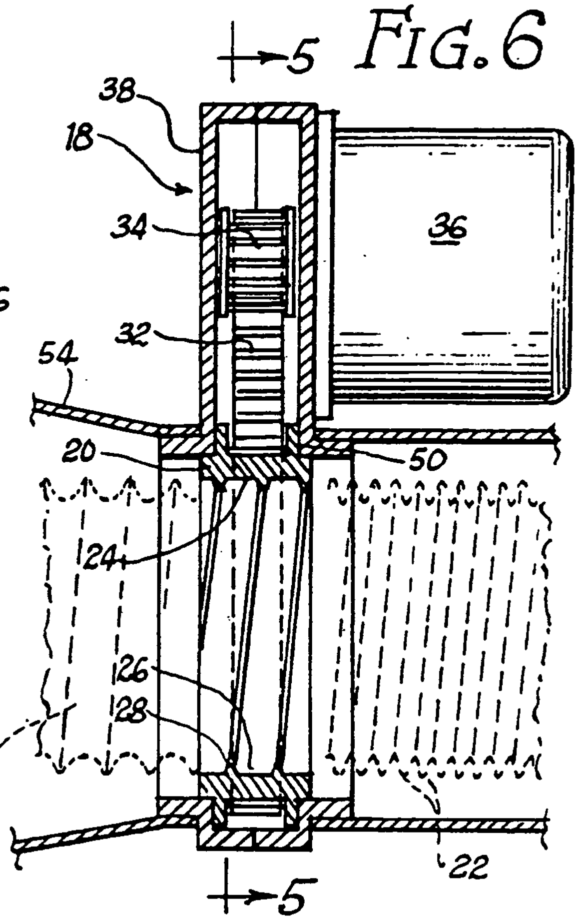


FIG. 7

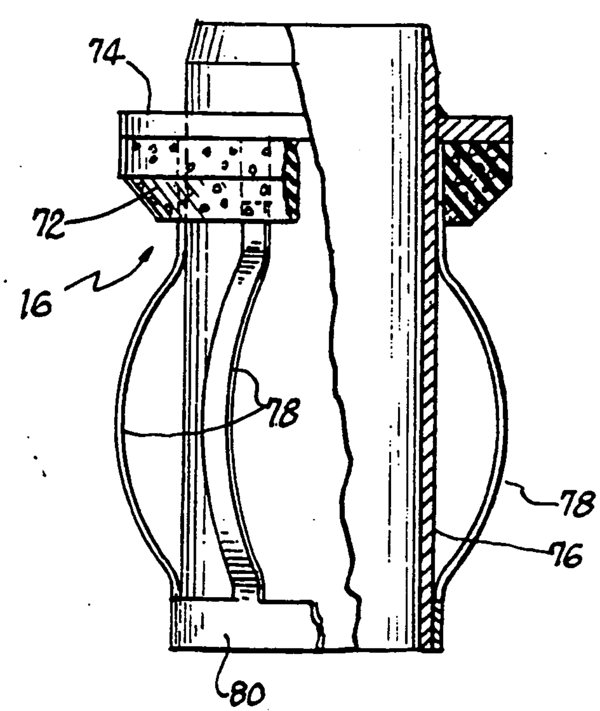


FIG. 8

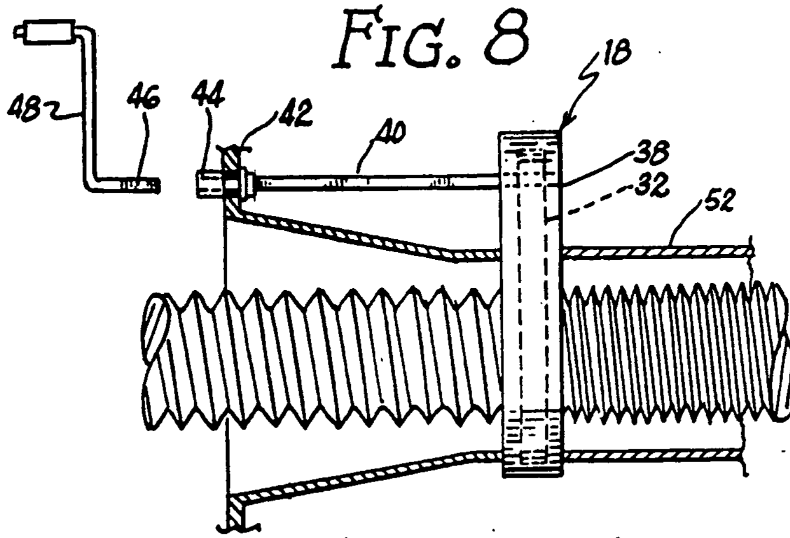


FIG. 9

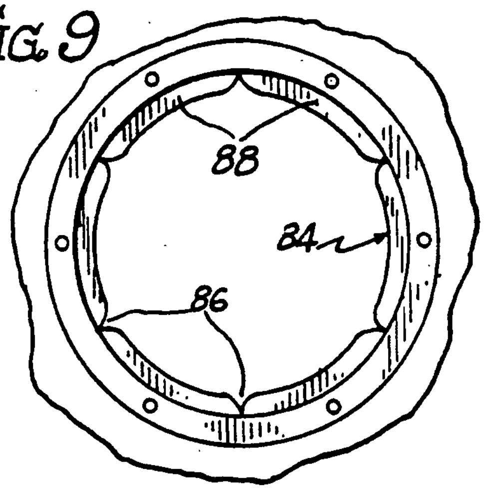


FIG. 10

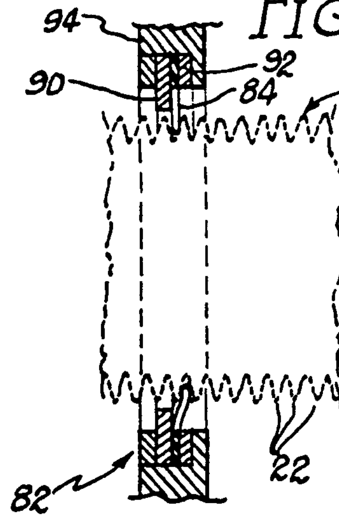


FIG. 12

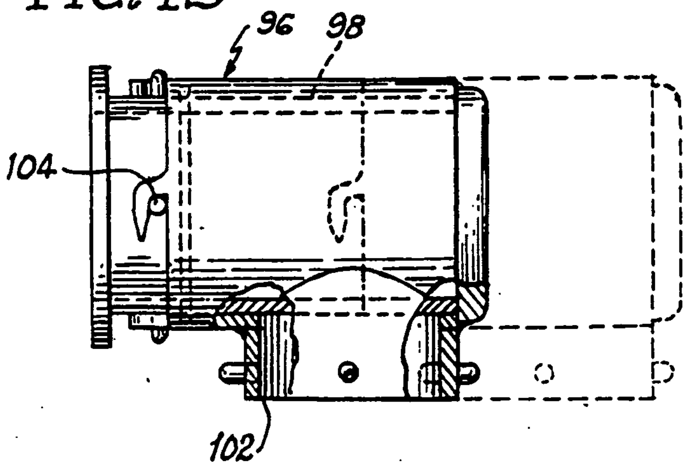
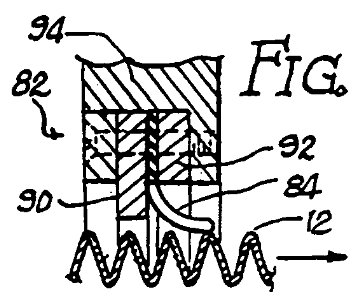


FIG. 11



EXTENDABLE WASTE HOSE SYSTEM

BACKGROUND OF THE INVENTION

One of the messiest and most dreaded aspects of using a recreational vehicle (RV) is dumping the waste of the holding tank into the inlet receptacle of an RV dump station. Traditionally, this is accomplished by means of a loose hose which connects to an outlet on the recreational vehicle by hand, with the other end being manually connected to the inlet of the dump station. Additionally, a fitting must be put on the outboard end of the hose so it adapts to the particular size of the inlet at that particular dump station. Inlets vary from 3" to 4½", so that the RV operator generally carries three adapters for the three commonly used sizes within that range. This system is the most labor intensive, the messiest, and the most old-fashioned.

Other systems have been developed, including one developed by the instant inventor on which a patent is issued bearing U.S. Pat. No. 4,133,347. This patent discloses a telescoping hose which fits inside a tubular housing, such that the hose can be pulled out to an extended position with the outer end then mated to the dump inlet. This avoids having a loose hose to deal with, and does not require attachment of the hose to the RV outlet in as much as it is always attached at that end. However, the outer end still must be mated to the dump station inlet, and some means must still be provided to keep the hose from sagging if the extension is very long to prevent pockets of waste from accumulating in the sags.

Several devices are commercially available for preventing sagging of the waste line. It is important that the waste line achieve a preferably uniform angle of decline from the RV to the ground level inlet to avoid the above-referenced waste accumulation in sags. If the run is short, this is not a problem. However, most runs are long enough that sags would occur, and spaced hose supports, or a collapsible parallelogram defining a long inclined hose support, are among the devices currently available to support the hose.

Additionally, there is at least one system which uses a telescoping rigid outer tube which supports the hose up to a certain length from the recreational vehicle. A system of this type is shown in U.S. Pat. No. 4,223,702, issued Sept. 23, 1980. The rigid outer tube defines an adequate incline, although very frequently runs substantially longer than the tube are required, leaving the problem of unsupported lengths of the tube unresolved.

There are thus at least three problems with the RV hose dump system which are in need of a better solution. First, a means for extending and retracting the hose without requiring manual pushing and pulling would be welcomed in the industry. Second, a universal adapter to mate the extended end of the hose to the dump station inlet without requiring three separate adapters to be carried on the RV would be a blessing indeed. Third, it would be very convenient to have a system for causing the hose to assume the proper incline without the use of yet more equipment that must be stowed on the vehicle, for use only in the dumping operation.

These needs break down into two general areas. First, it is obviously desireable to minimize or eliminate the paraphernalia that must be carried on the RV, where space is limited already, and which have no other purpose as collateral equipment beyond the waste draining operation. Second, the labor involved in draining the waste storage tank is not a labor of love, but is messy and something that is dreaded by all RV operators. A system that would reduce the number of steps and operations necessary to accomplish this function, and reduce the spillage and messiness of it, would be a boon to RV operators.

SUMMARY OF THE INVENTION

The instant invention fulfills all the above stated needs and goals. At its heart is an accordion hose driver, operated by either an electric motor or a crank, for extending the hose out to the appropriate length, or winding it back into its collapsed storage mode inside a cylindrical housing on the RV. This driver utilizes a collar around the hose, the interior surface of the collar being configured to engage the helical ribs of the accordion hose so that as the collar rotates in one direction or the other, the hose will extend or retract, respectively.

The system also includes means for tensioning the hose once it is extended with the outer end engaged in the dump station inlet, so that the tension holds the hose at the desired degree of inclination, with no sagging, without the need of any further hose support equipment.

Lastly, the terminal end of the hose is permanently fitted with an elbow-defining structure which will create a 90 degree bend in the end of the hose for convenient fitting in the waste station inlet a universal coupling for fitting inside the inlet of the waste station and adapted to accommodate any of the commonly used inlet sizes eliminates the need to carry multiple adapters, and also enables the fitting to become a permanent fixture at the end of the hose.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is the diagrammatic view of the system in use, connected between an RV and a waste dump inlet;

FIG. 2 is a more detailed view of the hose drive system and the elbow-defining and coupling structures at the outer end of the hose;

FIG. 3 is a side elevation view of one type of elbow-defining structure;

FIG. 4 is a side elevation view of another type of elbow-defining structure;

FIG. 5 is a section taken along line 5—5 of FIG. 6;

FIG. 6 is a side elevation view of the motor driven version of the hose driver showing the accordion hose in phantom;

FIG. 7 is a side elevation view, partially cut away, of the inlet coupling;

FIG. 8 is a side elevation view, partially cut away, of the hose drive mechanism utilizing a crank rather than an electric motor;

FIG. 9 is an elevation view of the unidirectional hose cuff;

FIG. 10 is a section taken along line 10—10 of FIG. 9 illustrating the structure that makes the hose tensioner unidirectional;

FIG. 11 is detail of one section of the hose tensioner illustrating the mechanism by which the hose becomes more greatly tensioned when pulled in one direction than the other; and,

FIG. 12 is a side elevation view of an elbow that can replace the end fitting on the hose or fit between the RV outlet and the hose.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An RV is diagrammatically illustrated at **10** in its parked position while the waste hose **12** is extended from the RV, where it connects internally to the holding tank, to the inlet **14** of an underground waste dump reservoir, not shown. The outer end of the hose terminates in a coupling **16** and an elbow **18** which can be provided in one of several forms all of which have the capability converting from the substantially 90 degree bend as shown to a generally linear extension to enable it to fit better in its compartment inside the recreational vehicle.

At the heart of the invention is the hose driver **18**. This driver works on a principle that is sometimes used to axially displace threaded shafts, wherein an external collar **20** engages around the accordion hose, which has a continuous helical rib **22**. The inner surface **24** of the collar defines a wide helical groove **26** between the collar's spaced ribs **28**, with the ribs in the groove being mated as indicated in FIG. **6** so that rotation of the collar will move the accordion hose to the left or to the right.

In the embodiment illustrated in FIG. **6**, the external surface of the collar **20** defines spaced teeth **30** around its circumference which are engaged by the toothed belt **32**, driven by the gear **34** of electric motor **36**. A belt housing **38** is used for the conventional reasons.

An alternative to the electric motor **36** is a hand-driven crank version illustrated in FIG. **8**. In this embodiment, a drive shaft **40** extends from the side **42** of the RV into the belt housing **38**, where it engages the belt **32** substantially as does the electric motor in the previous embodiment. The outer end of the drive shaft is fitted with a quad- or a hex-socket nut **44** which is engaged by the mating end **46** of the hand crank **48**. The crank handle is of course removed when not in use and stowed in the vehicle. Obviously other arrangements could be used, such as one in which the crank is collapsible against the outside or inside of the RV.

As shown in FIG. **6**, the collar **20** does not ride on roller or ball bearings, but simply slides in its track, being centered by the shoulders it defines at **50**. In order for this mechanism to work properly, the collar and the bearing surfaces of the belt housing in which the collar rotates must have a low-friction interface. To this end, the collar could be made of nylon or another low-friction material.

When the hose is collapsed as indicated in the right side of FIG. **6**, it is stowed within a collapsed hose housing **52**, and the inner end of the hose is permanently connected to the outlet of the waste holding tank of the recreational vehicle, which is not shown. The entire mechanism, including the housing **52**, is mounted to a framework attached to the superstructure of the vehicle, with the details of the framework and its connection to the vehicle depending on the make and model of the RV to which the mechanism is mounted.

The above description covers the hose drive system and attention is now directed to the external end of the hose which mounts at a right angle, or almost right angle, elbow, and the coupling for engaging the end of the hose in sealed relation to the inlet **14**.

Because the hose is under substantial stress even when it is supported along its length, it is not wise to cause the hose to bend from the upright orientation as it would come out of the outlet **14**, to the angular orientation necessary to traverse the distance to the RV. In other words, a mechanical elbow is required just above the dump station inlet. Obviously a rigid elbow could be used, but it is one of the goals of the instant invention to permit the end of the hose to straighten out for stowage, so that it will fit conveniently inside the coupling housing **54**, shown in FIGS. **2** and **6**, and permit the door **56**, shown in FIG. **2**, to close to define a substantially flush outer surface for the wall of the RV.

To this end, three separate mechanisms are shown as alternatives for creating the elbow bend. First, as shown in FIG. **2**, which is the preferred embodiment, a pair of spaced ferrules **58** are mounted to the exterior surface of the hose as shown. The ferrules could be bonded to the hose, but would more likely be provided with the same type of interior grooving as the collar **20**, and just rotated on to the end of the hose before the coupling is installed.

At one edge of each ferrule is an eyelet **60**, and one of the eyelets mounts a hook **62**. The other eyelet serves as a point of engagement for the end of the hook. Thus when the hook is engaged as shown in FIG. **2**, an elbow is defined and when it is unhooked, clearly the hose is free to form into its linear mode. It should be noted that the hook **62**, in addition to defining the bend, will take most of the tension exerted on the hose so that it is not expressed across the bent portion of the hose which defines the elbow itself.

In a second embodiment of the elbow, shown in FIG. **3**, a rotary joint **64** is used, which comprises a pair of annular flanges **66** held firmly together by a retainer ring **68**. The phantom lines in FIG. **3** illustrate the position taken by the mechanism when straightened, which is not entirely straight, but rather defines a slight S-curve.

Lastly, FIG. **4** illustrates a typical stovepipe bend system in which telescoping pipe segments **70** can be moved to define any desired angle, including straight, as shown in phantom in that figure.

It is one of the aims of the instant invention to eliminate the cumbersome hose support structure that is currently use to maintain the hose at the appropriate incline during dumping. With the instant invention, this is accomplished in the following manner. After the RV pulls up to the dump site, the hose is extended by the hose drive mechanism until the coupling **16** reaches the dump inlet **14**, at which point the coupling is inserted into the inlet. The coupling engages into the inlet fairly securely. At this point, there is likely to be a large sag in the hose as shown in phantom in **72** in FIG. **1**. Clearly, this sag is unsatisfactory as waste would accumulate in the low portion. Therefore, once the coupling is securely in the inlet, the hose drive **18** is reversed, winding the inner end of the hose back into the housing **52**, thereby tensioning the hose until it substantially straightens, eliminating the central dip. Hose strength of currently used hoses is more than adequate to sustain the require tension, and the coupling also is sufficiently strong, and engages in the inlet with sufficient friction to prevent its breaking or popping free of the inlet while the hose is being tensioned.

This simple expedient of reverse-driving the hose drive mechanism briefly after the hose is in place eliminates major pieces of cumbersome equipment that otherwise must be stowed in the scarce storage space of the vehicle. To an extent it is a natural offshoot of the use of the bi-directional hose driving mechanism, which is almost certainly new in this application.

Directing attention now to the coupling **16**, in the prior art the different sized couplings, general three in number, which were attached to the end of the hose to fit in the variously sized inlets, sealed by means of having a cylindrical nozzle which fit fairly tightly inside the cylindrical inlet **16**, thus defining a reasonable good seal between the cylinders. The instant invention deviates from this concept and provides a seal instead between a foam rubber gasket **72**, best shown in FIG. **7**, and the top of the inlet. This gasket is backed by a rigid ring **74** with the ring and gasket both being mounted on a cylindrical nozzle **76**. The difference in diameter between the cylindrical nozzle **76**, ring **74** and gasket **72** is such that the nozzle will fit inside the smallest diameter inlet, ordinarily 3", and the gasket is wide enough to seal against inlets up to 4½" wide, ordinarily the widest inlet in use at dump stations.

Naturally to create a good seal, some means of compressing the sealing gasket **72** against the top of the inlet is required, and in the preferred embodiment this means comes in the form of a series of spaced, longitudinally extended spring fingers **78**. These spring elements are connected at the bottom with a ring **80**, of which they are apart, and extend up inside the gasket, where they are permitted to slide up and down to accommodate the compression of the fingers by the sides of the inlet **16**. This frictional mechanism permits a pressed fit of the coupling into any inlet, resulting in there being adequate friction between the spring fingers and the sides of the inlets to hold the gasket **72** firmly down against the top of the inlet.

Another feature of the invention is the unidirectional hose tensioner **82**, illustrated in FIGS. **9-11**. The unidirectional hose tensioner could be used to replace the drive mechanism **18**, or it could be used by the drive mechanism as the collar **20**, will the advantages described below.

The hose tensioner is simple in construction, comprising of a flexible, planar annular ring **84** which is preferably divided by V-cuts **86** into a series of angularly spaced segments **88**. The periphery of the ring **84** is continuous and is not broken by the V-cuts. The periphery is sandwiched between two rigid support rings, an outer support ring **90** and an inner support ring **92** of larger internal diameter than the outer ring **90**. These rings are compressed in a suitable housing **94**.

The whole purpose of the hose tensioner is accomplished by the differing internal diameters of the support rings **90** and **92**. Because the outer ring **90** is smaller in internal diameter, it supports the ring **84** to a much greater extent than does the ring **92**, so that when the hose is pulled outward, or to the left in FIG. **10**, it encounters much greater resistance from the ring **84** than when the hose is pushed back into the vehicle or to the right in FIG. **10**.

For this reason, when the tensioner is used as the collar **20**, the hose ribs would pass through the V-cuts **86** without any problem. When the tensioner is rotated by the hose drive mechanism, it would axially drive the hose in or out, just as does the collar **20**. Additionally however, the hose can be pulled out when the hose drive is de-energized, if enough tension is put on the hose. When it is desired to push the hose back into its housing **52** however, much less resistance is provided by the tensioner.

Use of the tensioner as the collar has at least two advantages. First, in the event the hose drive mechanism breaks down, the hose can still be pulled out although requiring considerable force. Because of requiring such force, the hose can be pulled out with the coupling engaged in the inlet **16**, with enough tension on the hose to keep it in its inclined mode shown in solid line in FIG. **1**, even though the hose drive is not functional. The second advantage is that even if the hose drive is working, it might take 60 seconds or so for the electric motor, or the crank, to drive the hose back into its housing **52**, whereas it could simply be pushed in by the operator in a much shorter period of time.

The above description describes the unidirectional hose tensioner as it would be used in conjunction with hose drive mechanism. However, as indicated above, it could be used to replace the drive mechanism entirely, while still permitting all of the other features and advantages of the waste system disclosed herein to be quite adequately functional. The only disadvantage is that the operator would now have to pull the hose out through the hose tensioner, rather than using a crank or an electric motor. However, pushing the hose back into its housing, as already discussed, would be quite quick and easy due to the tensioning differential capabilities of the hose tensioner between extending and retracting the hose.

Another optional component of the invention is the elbow **96**, illustrated in FIG. **12**. This elbow has a rigid stub pipe **98** and an end pipe **100** which slides axially along the stub pipe. The end pipe has a side outlet **102** which communicates freely with the stub pipe **98** when the pipe is pulled out into its open position shown in phantom in FIG. **12**, but is closed off when the stub pipe is pushed in and locked with the hook-and-peg latches **104**. Other latching means could be provided to lock the end cap in the extended mode shown in phantom.

The elbow **96** can be used in two possible places: either at the upstream end of the hose, connecting the hose to the RV, or as the elbow bend and cap at the end of the hose that connects to the RV waste system. When used at the upstream end, the unit accommodates a code requirement that the RV waste system terminate in a rigid coupling rather than a hose. When used at the downstream end of the hose, another coupling/adaptor would be required to adapt the outlet **102** to the dump station inlet.

As can be seen from a study of the prior art in the field of recreational vehicle dump systems, waste dumping is the problem to which many have directed their attention. However, their attention has ordinarily been directed to component problems of the entire operation, rather than defining a different operation that substantially eliminates the component problems. For example, one patent might illustrate a system for storing the collapsed waste hose conveniently underneath the recreational vehicle, while another patent might disclose an apparatus for supporting the hose along its length to define the required incline. To accommodate different inlets, different coupling are provided. However, what is needed, and what this invention provides, is a comprehensive system which attacks all of the problems incidental to waste dumping from a recreational vehicle, and minimizes the aggravation and waste spillage, while maximizing speed, efficiency, and convenience of the operation.

I claim:

1. In a recreational vehicle having storage means for liquid waste, a hose member in communication with said storage means for use in discharging waste therefrom,

said hose member being of accordion construction with a ribbed external surface to enable said hose member to be longitudinally extended into an extended dumping mode and longitudinally collapsed into a compact stowage mode,

a housing for stowing said hose member in said compact stowage mode, said housing having an outlet opening through which said hose is extendable,

hose drive means located externally of said hose member adjacent said housing and physically engaging said hose member ribbed external surface for selectively extending said hose out of said housing through said opening into said hose member extended dumping mode and retracting said hose member through said opening back into said housing into said compact stowage mode and,

said hose member having an inner end for connection to said waste storage means and an outer end including a coupling for insertion into a waste inlet of a waste dump station.

2. Structure according to claim 1 wherein said hose is a helically ribbed accordion hose and said hose drive means comprises a collar disposed around said hose and rotationally slidably engaging the helical ribs of said hose and means for rotating said collar selectably in opposite directions about its axis to alternatively extend and retract said hose.

3. Structure according to claim 2 wherein said means for rotating said collar comprises an electric motor.

4. Structure according to claim 3 wherein said electric motor drives a belt which extends around the circumference of said collar to drive same.

5. Structure according to claim 2 wherein said collar defines an internal helical groove to substantially conform to the external contours of said helically ribbed hose.

6. Structure according to claim 2 wherein said collar engages said hose by means of an inwardly directed resilient annular flange which is reinforce against outward deflection more than it is against inward deflection such that said hose can only be pulled out into the extended mode by exerting a great deal of extending tension on the hose and wherein said hose can be easily pushed back through the collar into said stowage mode.

7. Structure according to claim 2 wherein said means for rotating said collar comprises a manually rotatable crank.

8. Structure according to claim 1 wherein said coupling comprises an annular sealing ring compressible against the top of the waste inlet to seal against same and frictional means for pressing outward against the inside of said inlet to hold said sealing ring securely against the top of said inlet.

9. Structure according to claim 8 wherein said annular sealing ring defines a resilient foam face for compressing against the top of the waste inlet.

10. Structure according to claim 9 wherein the coupling of the outer end of said hose defines a cylindrical spout extending beyond said sealing ring, and said frictional means comprises a plurality of longitudinally extended bowed spring fingers angularly spaced around said spout, said spout and fingers being dimensioned such that said spout and fingers will insert into and fictionally grip waste inlets ranging in diameter from 3" to 4½".

11. Structure according to claim 1 wherein said coupling includes means of releasably establishing a substantially right-angle bend in said hose to permit said hose to be conveniently insert into said inlet.

12. Structure according to claim 11 wherein said bend is defined by a pair of ferrules encircling said hose at spaced positions near the outer end thereof, and a connector pulling said ferrules together at one point on each ferrule.

13. Structure according to claim 11 wherein said bend is defined by a rigid 90 degree angle elbow at the outer end of said hose, said elbow having a rotary joint at about the 45 degree position thereon.

14. Structure according to claim 11 wherein said bend is defined by a rigid stub pipe engaged on the outer end of said hose, and an end pipe slidable on said stub pipe and lockable thereon in a fully engaged position in which said end pipe is substantially completely inserted over said stub pipe, said end pipe having a side outlet and being slidable out on said stub pipe sufficiently far that said outlet communicates with said stub pipe such that said outlet can be connected to the inlet of an RV dump station.

15. A waste hose system comprising: a storage housing

a longitudinally collapsible hose having a longitudinal axis, rib means forming a ribbed exterior surface on said hose of alternating ridges and grooves and coupling means at one end of said hose for coupling said hose to a waste inlet of a waste dump station, said hose being axially moveable between a collapsed position inside of said storage housing and an extended in use position; and

drive means located externally of said hose member adjacent said housing and including a rotatable drive member extending into said grooves and frictionally engaging said hose so that rotation of said drive member in one direction moves said hose longitudinally to said collapsed position and rotation of said drive member in the other direction moves said hose longitudinally to the extended position so that the length of hose between said coupling means and drive means can be varied to thereby prevent sagging in the hose when in the extended in-use position.

16. The waste hose system of claim 15 wherein said drive means includes an annular drive member surrounding said hose and engaging said hose rib member.

17. The waste hose system of claim 15 wherein said rib means includes a helical rib member forming a ribbed external surface on said hose of a continuous spiral groove.

* * * * *

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United States Patent [19]

Collins

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[45] Date of Patent: Jan. 7, 1992

[54] AUTOMATICALLY OPERATED GATE VALVE FOR RECREATIONAL VEHICLES

[76] Inventor: Richard Collins, 2981 Hillman-Ford Rd., Morral, Ohio 43337

[21] Appl. No.: 560,560

[22] Filed: Jul. 30, 1990

[51] Int. Cl.[5] F16K 3/02; F16K 31/163

[52] U.S. Cl. 137/899; 4/323; 137/554; 251/30.05; 251/58

[58] Field of Search 4/323; 137/554, 899; 251/30.05, 58

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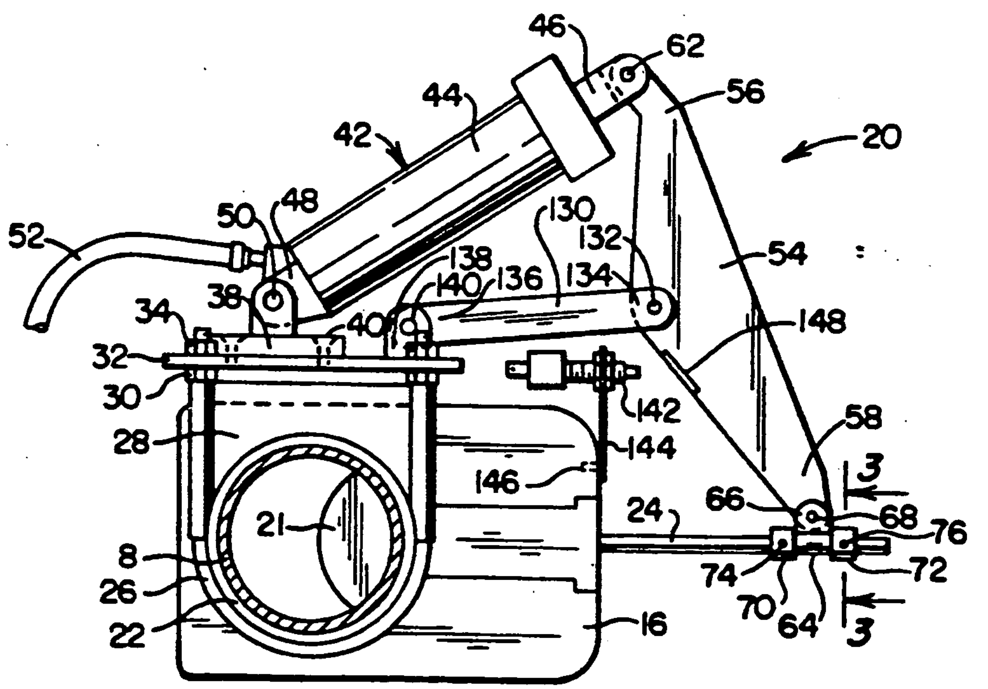
Primary Examiner—Gerald A. Michalsky
Attorney, Agent, or Firm—Watkins, Dunbar & Pollick

[57] ABSTRACT

This invention is a hydraulic device for operating a gate valve in the drainage line of a recreational vehicle. The device consists of a support plate mounted to the gate valve or drainage line. A hydraulic cylinder with a hydraulic rod is pivotally mounted to the support plate. The hydraulic rod is attached to the gate control rod by means of a pivot arm that is also pivotally attached to the support plate. The device is operating by means of a hydraulic pump, a motor and control means for operating the motor, typically an electrical switch.

28 Claims, 3 Drawing Sheets



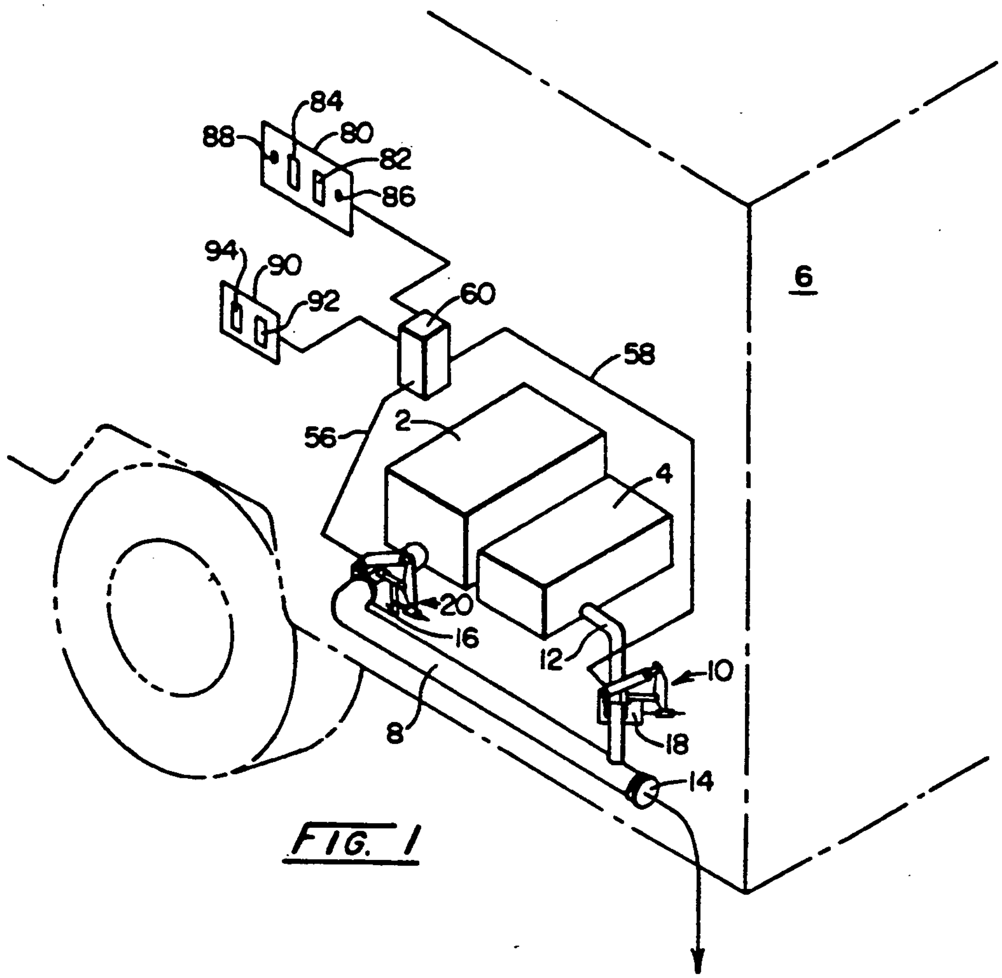

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FIG. 1

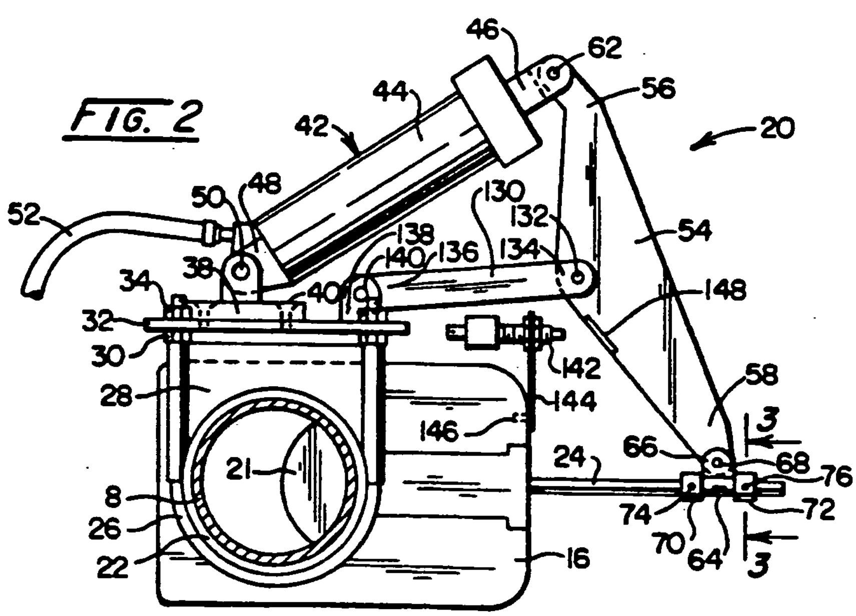
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FIG. 2

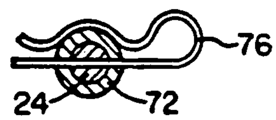


FIG. 3

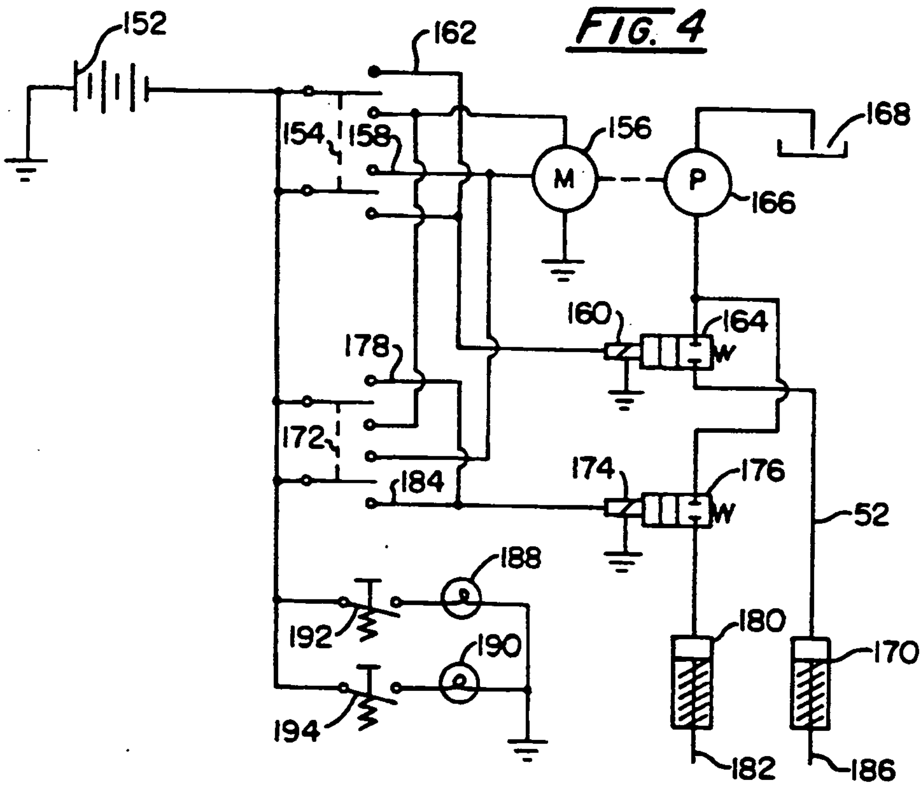


FIG. 4

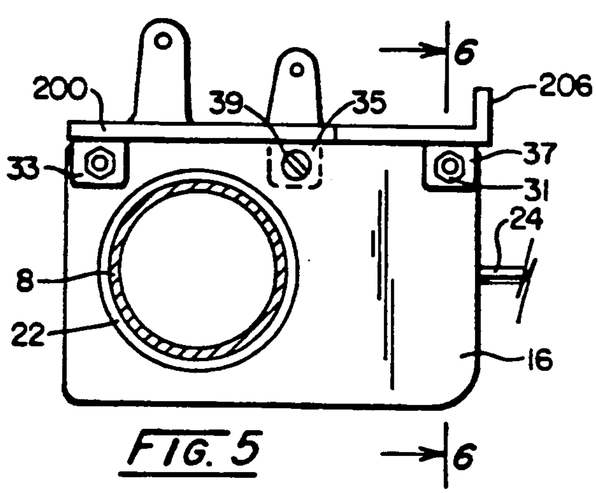


FIG. 5

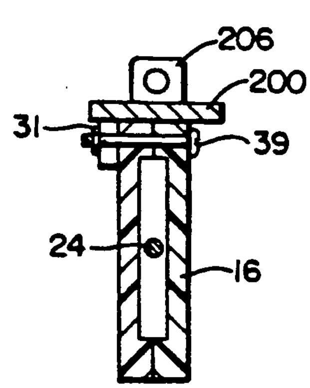
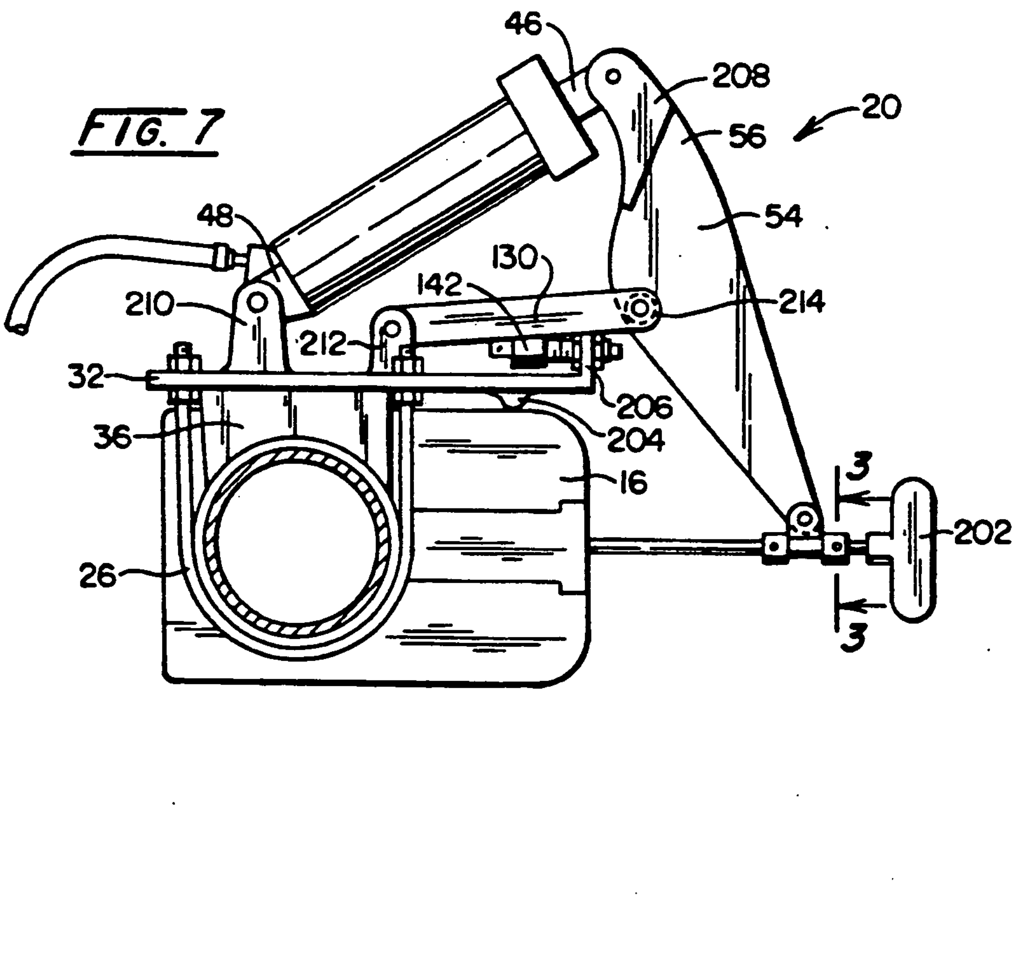


FIG. 6

FIG. 7



AUTOMATICALLY OPERATED GATE VALVE FOR RECREATIONAL VEHICLES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to gate valves, and more particularly to automatically operated gate valves for use with holding or similar tanks for recreational or similar type vehicles.

2. Description of the Prior Art

Users of recreational vehicles outfitted with a water closet, tub or shower or both, and a kitchen sink are required to discharge the waste and gray water from these fixtures into onboard holding tanks that must be discharged or dumped into an approved sanitary sewer or septic system usually located in a trailer court or camp ground.

Users of recreational vehicles often find it inconvenient or difficult to dump the holding tanks into sanitary facilities because of their own physical limitations, bad weather conditions, darkness, etc. Dumping typically requires kneeling down and reaching under the vehicle for a distance of two to two and a half feet. In this position, the operator is off-balance and unable to obtain good leverage to operate a manual gate valve. This can be especially troublesome for those of slight build, the elderly and the handicapped. Moreover, while operating the gate valves, the operator is sure to be contaminated with waste should there be a failure in the waste hose, hose connection or hose clamp. In addition, gate valve operation can be especially worrisome in strange surroundings and especially annoying and frustrating in foul weather or when biting insects are at their peak.

One approach to this problem has been through the development of telescoping drain assemblies that are swiveled and telescoped to the discharge site such as revealed in Feliz U.S. Pat. No. 3,811,462 and Sargent et al. U.S. Pat. No. 4,779,650. Although these inventions attempt to solve the piping problem between the discharge line of the vehicle and the discharge point, neither of them address the problem of valve control since both of these inventions continue to use manually operated valves to open and close the discharge lines.

Kemper et al U.S. Pat. No. 4,214,324 and Perez U.S. Pat. No. 4,693,447 disclose waste dump valves that are electrically controlled for use in aircraft and railroad cars respectively. Hilde, Jr. U.S. Pat. No. 3,375,025 is directed to a pneumatic valve mechanism for use with a mobil system for evacuating and recharging portable commodes.

Pierson U.S. Pat. No. 3,941,349 is directed toward the development of electromechanically actuated gate valves. Pierson's inventions, however, have several shortcomings and problems. First, all of Pierson's mechanisms for controlling the gate valve are contained within the housing of the gate valve itself. As such, it is not possible to convert an existing manual valve to a mechanically operated device. All the vehicle owner can do is to remove the manual valve and replace it with one of Pierson's electromechanically operated valves. Further if the electromechanical mechanism of the Pierson valve breaks down, it is impossible to repair it with out removing it from the drainage line—a process which requires replacement of a portion of the drainage lines in addition to the repair or replacement of the valve itself.

Pierson's solenoid driven valves are spring biased so as to remain in the closed position unless the solenoid is electrically actuated. As a result, Pierson's solenoid devices must draw current continuously while the holding tank is being emptied thereby adding to the cost of operation and increasing the potential for failure as a result of electrical short or burnout. Such continuous operation also increases the chance for an electrical fire. Moreover, Pierson's closed biased solenoid valves do not allow the valve to be left in an open position, even by manual operation. In many instances this is the preferred position, especially when the vehicle has been permanently parked and the drainage line hooked up to the sanitary sewer. In such a setting, the drainage line is left open without further consideration. Using the Pierson valve, the vehicle user must periodically open the gate valve to drain the holding tanks even when the vehicle is in a parked mode and connected to a sanitary sewer. Such additional operation tends only to shorten the life of the Pierson valve. Because Pierson's solenoid valves effectively have only a fully opened or closed position, it is impossible to adjust the volume of discharge from the holding system. In the event of a power failure, the user of a Pierson solenoid valve must resort to manual operation of the valve in order to empty the holding tanks.

Pierson has also developed motor driven direct drive and gear drive valves. Such motor driven valves are more complex than the solenoid valves thereby increasing the potential for malfunction. Since the drive mechanisms are contained within the valve housing, the only way to repair such valves is by removing them from the drainage line, which, as we have seen, is costly since portions of the drainage line must be replaced along with possibly the valve itself.

SUMMARY OF THE INVENTION

The present invention overcomes the inconvenience and burden of operating the manual valves found on most recreational vehicles, especially in inclement weather, strange surroundings, and other environmental hostilities which make such valve operation especially onerous for the weak, elderly and disabled. It also overcomes the problems and obstacles encountered with the self-contained electromechanically operated valves found in the prior art, especially the inability to convert an existing manual valve to a mechanical valve, the inability to set the valve to any position including fully opened or closed, and the necessity for unneeded or prolonged operation under certain conditions that do not justify such operation and serve only to add to the cost of operation, reduce the operational life time, and increase the risk of electrical short or fire.

The present invention consists of a hydraulic device that is connected to the gate of a gate valve for the purpose of opening and closing the valve. The invention can be used to convert existing manual gate valves to hydraulically operated valves without removing the existing valve from the drainage line of the recreational vehicle (RV). Because it can be mounted on the existing valve or drainage line, it can be readily removed for repair or replacement without the need to remove the gate valve from the drainage line. Although the device can be installed within the gate valve housing, it is preferable not to do so for the above mentioned reasons.

Various additional features of the invention allow the gate valve to be stopped at any position between fully opened and fully closed so as to adjust the volume of

discharge form the holding system. The invention uses energy only in moving the valve from one position to another. No energy or power is required to hold the valve in any desired position and thus the valve will remain in the selected position even when power is lost. The invention can be disconnected from the valve to allow for manual operation of the valve to any position should the device ever fail or power be lost. The valve can be operated from remote locations, typically from within the RV and from a control panel located on the exterior of the RV preferably in the area of the drainage discharge. The invention can also be provided with an indicator such as a light, buzzer, or dial to indicate the position of the gate valve.

The invention is not limited to RVs but can be used in any vehicle having holding tanks where it is desirable to control the opening and closing of the drainage line from the holding tanks.

In one basic form, especially useful for opening, closing, or holding a holding tank gate valve in any position where the gate valve is located in a passage connected to a holding tank of a recreational or similar type vehicle, the invention consists of a hydraulic cylinder that has a cylindrical housing with a hydraulic rod projecting from the center of one end, a way or means for connecting the hydraulic rod to the gate of the gate valve and a means for controlling the movement of the hydraulic rod into and out of the hydraulic cylinder housing. Typically, the means for controlling the movement of the hydraulic rod into and out of the housing is a hydraulic pump for pumping hydraulic fluid into and out of the housing so as to cause the hydraulic rod to move into or out of the housing. A motor is used to operate the hydraulic pump and is, in turn, controlled by a switch device. Generally, an electrical motor and an electrical switch are preferred, however, it is to be understood that there are other means for operating hydraulic pumps such as a hydraulic motor and that such a device can be operated by vacuum or air pressure switching devices.

A valve can be placed in the hydraulic line for maintaining the amount of hydraulic fluid in the hydraulic cylinder so as to control the position of the gate within the gate valve. The opening and closing of this valve can be controlled by a suitable means such as a solenoid.

The motor that is used to move hydraulic fluid into and out of the hydraulic cylinder is preferably a reversing motor. When a reversing motor is used, the switching means for controlling and operating the motor should be capable of operating the motor in either a forward or reverse direction. It is desirable to the switching means for controlling the operation of the motor to be placed at two or more remote locations. For example, it is desirable to have one control means such as a switch panel located within the recreational vehicle so that one does not have to leave the recreational vehicle to control the opening and closing of the gate valve. A second desirable location for the motor switching or control means is on a panel located on the outside of the vehicle near the point of discharge of the drainage system. In such a location, the user of the RV can monitor the discharge operation into the sanitary sewer.

It is also desirable that the hydraulic means for operating the gate valve be capable of being disconnected from the gate valve so as to operate the gate valve in the event of loss of power or energy with which to operate the hydraulics of this invention. In such a case, the hydraulics can be disconnected by means of a locking pin or other such quick disconnect type feature. When the hydraulics are disconnected, a handle can be attached to the gate rod of the gate valve so as to manually operate the valve.

Finally, it is desirable to know the position of the gate within the valve. This can be achieved by providing a sensing and indicating mechanism for determining the position of the gate within the gate valve. The sensing mechanism is typically a switch responsive to the position of the gate while the indicating means can be a visual indicating means such as a light or dial, or an audible means such as a buzzer or bell.

Another aspect of the invention is a means for externally mounting a gate valve hydraulic control device, preferably a hydraulic control device, on either the gate valve or the drainage line. This aspect of the invention consists of a support plate and a means for fastening the support plate to the drainage line or the external portion of the gate valve housing. In its simplest form, the fastening means can simply be one or more U-bolts that pass around the drainage line and pass through aligning holes in the support plate where they are fastened to the support plate by means of bolts. For additional stability, a saddle piece conforming to the drainage line can be secured to the U-bolt after it passes around the drainage line by means of bolts and then the support plate bolted on to the projecting ends of the U-bolts.

In another embodiment, rather than using the saddle piece after the U-bolt passes around the drainage line, the support plate may have on its under surface one or more projecting tangs having a surface conforming to a portion of the circular surface of the drainage pipe. In this embodiment, the support plate rests on the drainage line as a result of the downward projecting tangs that conform to the drainage line and the U-bolt passes around the drainage line up through the apertures in the support plate and are bolted to the upper surface of the support plate.

In another embodiment, a suitable slot can be formed in the downward projecting tang that conforms to the drain line and a hose-type clamp passed there through and secured around the drainage line. The downward projecting tang that partially conforms to the drainage line curvature can also be extended sideways (outward) beyond the support plate and the hose clamp passed around both the projecting tang and the drainage line and fastened around both.

In all of these configurations, it is to be understood that preferably two U-bolts are used and that they are located on both sides of the gate valve housing and that, if more than one downwardly projecting tang is used, they are located in such a fashion so that the gate valve housing can rest between the projecting tangs. It is also to be understood that the U-bolt can pass around the drainage line or around the circular boss that is part of the gate valve housing that receives the drainage line.

A hydraulic cylinder that consists of a cylindrical housing with a hydraulic rod projecting from one end is attached to the support plate by suitable means. Such means can consist of two upwardly projecting, support plate tangs with aligning holes. The tangs are positioned so as to receive a boss on one end of the cylinder housing that has an aperture in it so that the apertures in the tangs and the aperture in the boss align so as to receive a pivot pin. The pivot pin is locked into place by any suitable means including a forced fit into the apertures in the tangs or a head at one end of the pivot pin, too

large to pass through the tang apertures and a cotter pin, nut or other suitable attaching means at the other end.

A pivot arm with a first and a second end and a pivoting means between the two ends is secured to the projecting end of the hydraulic rod. In a simple version, the projecting end of the hydraulic rod and the first end of the pivot arm have aligning holes through which a pivot pin is passed and locked into place by means of a cotter pin or other suitable means. In a preferred and more stable version, the pivot arm has two legs that project from the first end with each leg having an aligning hole through it. The end of the hydraulic rod also has a hole in it and the end of the hydraulic rod is received between the legs of the pivot arm so that the holes in the legs of the pivot arm and the hole in the end of the hydraulic rod align so as to receive a pivot pin that is suitably secured.

The other end of the pivot arm is suitably secured to a control rod of the gate valve. This control rod is joined at one end to the gate of the gate valve and at the other end to the second end of the pivot arm. The second end of the pivot arm is secured to an end of the control rod by means of a collar that passes around the control rod and has a projecting tang to receive the second end of the pivot arm. The pivot arm and the tang of the collar have suitable aligning apertures for receiving a pivot pin through them. The pivot pin is secured by means of a locking pin. By removing the locking pin and pivot pin, the control rod is capable of being disconnected from the hydraulic mechanism of this invention. The collar can be secured on the end of the control rod by means of other collars that are securely attached to the control rod by means of set screws or other locking devices and are positioned on either side of the tanged collar. Alternatively, the tanged collar can itself have a set screw for locking it to the control rod.

The invention further consists of a means for securing the pivoting means of the pivot arm to the support plate. This is accomplished by providing a connecting plate that is attached at one end to the pivot means of the pivot arm and at the other end to a tang projecting from the support plate. Both ends of the connecting plate are attached to the tang and to the pivot arm by means of a pivot pin and suitable fastening means for the pivot pin.

As discussed previously, the hydraulic cylinder is operated by means of hydraulic fluid, a method or means for pumping the hydraulic fluid into or out of the cylinder or both, such means being a motor, preferably a reversing motor, a control means for controlling the motor, hydraulic valves in the hydraulic line for controlling the amount of hydraulic fluid in the cylinder and as a result, the position of the gate in the gate valve, and means for controlling the hydraulic valve such as a solenoid.

The foregoing and other advantages of the invention will become apparent from the following disclosure in which one or more preferred embodiments of the invention are described in detail and illustrated in the accompanying drawings. It is contemplated that variations in procedures, structural features and arrangement of parts may appear to a person skilled in the art without departing from the scope of or sacrificing any of the advantages of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial perspective and schematic view of a vehicle embodying the present invention.

FIG. 2. is a plan view of an embodiment of the valve operating mechanism of the present invention.

FIG. 3. is a cross-sectional view of the invention disconnect means along line 3—3 of FIG. 2.

FIG. 4 is a schematic diagram of the electrical and hydraulic system of this invention.

FIG. 5 is a plan view of an alternate method for attaching the support plate to the valve.

FIG. 6. is a cross sectional view of the support plate securing means along line 6—6 of FIG. 5.

FIG. 7 is a plan view of an alternate embodiment of the valve operating mechanism of the present invention.

In describing the preferred embodiment of the invention which is illustrated in the drawings, specific terminology is resorted to for the sake of clarity. However, it is not intended that the invention be limited to the specific terms so selected and it is to be understood that each specific term includes all technical equivalents that operate in a similar manner to accomplish a similar purpose.

Although a preferred embodiment of the invention has been herein described, it is understood that various changes and modifications in the illustrated and described structure can be affected without departure from the basic principles that underlie the invention. Changes and modifications of this type are therefore deemed to be circumscribed by the spirit and scope of the invention, except as the same may be necessarily modified by the appended claims or reasonable equivalence thereof.

DETAILED DESCRIPTION OF THE INVENTION AND BEST MODE FOR CARRYING OUT THE PREFERRED EMBODIMENT

FIG. 1 is a perspective view showing the general arrangement of the components of this invention in a recreational vehicle (RV) 6 shown in phantom. It is to be understood that the invention is not limited to RVs but, in fact, could be used in any mobile vehicle where it is necessary or desirable to have one or more holding tanks and to periodically discharge such holding tanks.

Waste water from toilets (water closets; not shown) is discharged into a waste water holding tank 2 while gray water from sinks, showers, and bath tubs (not shown) is discharged into a gray water holding tank 4. The discharge line 12 from the gray water tank is typically connected to the discharge line 8 from the waste water holding tank 2. Discharge line 8 has a cap 14 at its end to prevent inadvertent discharge into the environment. Manual gate valves 16 and 18 are incorporated into discharge or drain line 8 and discharge or drain line 12 to control the flow of waste water and gray water from the holding tanks 2 and 4, respectively.

In normal operation, the cap 14 is removed from the end of the discharge line 8 and connected to the sanitary sewer by means of a flexible pipe or other connecting means(not shown). The waste water holding tank is first discharged by opening gate valve 16. After the waste water holding tank 2 has been discharged, gate valve 16 is closed and the gray water holding tank 4 is discharged by opening gate valve 18. The gray water holding tank 4 is discharged after the waste water in order to rinse the flexible pipe or other connecting means. Gate valves 16 and 18 are then closed and the end cap 14 replaced on discharge line 8.

As can be seen in FIG. 1, gate valves 16 and 18 are typically located below and toward the center of the

RV 6. As such, the operator must kneel or otherwise position him or herself under the vehicle to open manually gate valves 16 and 18. Such a position is particularly uncomfortable and insecure at night and strange surroundings especially when accompanied by biting insects and drenching rain. Such a position can be particularly unpleasant should the flexible pipe or other means for connecting drainage pipe 8 to the sanitary sewer come lose during the discharge of waste water from holding tank 2.

This invention eliminates the need for manual operation of gate valves 16 and 18 by providing hydraulic mechanisms 20 and 10. These mechanisms are essentially similar in nature except for the fact that they are of different sizes to accommodate the different sized gate valves found in the different sized waste water and gray water lines. The hydraulic mechanism is connected to a hydraulic pump, motor, and other control devices indicated schematically by the numeral 60 in FIG. 1. The hydraulic mechanisms 10 and 20 are connected to the hydraulic center 60 by means of hydraulic lines 58 and 56.

Typically, the switch means 80 is located within the recreational vehicle 6 while switch means 90 is located on the outside of the recreational vehicle 6 in such a position so as to allow the user to observe the drainage of the tanks into a sanitary sewer. Switch means 80 has a switch 82 for controlling hydraulic means 10 and switch 84 for controlling hydraulic mechanism 20. Switch means 90 has a switch 92 for controlling hydraulic mechanism 10 and switch 94 for controlling hydraulic mechanism 20. Switch means 80 also has an indicator light 86 to indicate the position of gate valve 18 and indicating means 88 for indicating the position of gate valve 16.

By placing hydraulic mechanisms 10 and 20 on gate valves 16 and 18, it is possible to discharge the waste water from tanks 2 and 4 either remotely from within the recreational vehicle 6 or from a position on the outside of the RV 6 so as to observe the discharge from the tanks. Such hydraulic mechanisms completely eliminate the need to crawl under the RV to open gate valves 16 and 18.

FIG. 2 is a front elevational view showing the details of the operation of the hydraulic mechanism 20. The gate valve (gate valve housing) 16 has a circular boss 22 for receiving an end of the discharge line 8. The drainage line 8 is joined to the circular boss 22 of the gate valve 16 by suitable means such as a plastic cement. The gate valve 16 has a control rod 24 that is attached to the gate 21 of the gate valve and projects from the gate valve 16 so as to control the movement of the gate by being pushed into or pulled out of the gate valve 16.

In the embodiment shown in FIG. 2, a clamp 26 is passed around the circular boss 22. A saddle member 28 is then placed on the U-clamp and the U-clamp firmly bolted to the circular boss by means of nuts 30. Two U-clamps are used on each side of gate valve 16. A support plate 32 having appropriate aligning apertures therethrough to receive the ends of the U-clamp 26 is then placed on the ends of the U-clamp 26 and firmly secured to the U-clamp by means of nuts 34.

In an alternate and preferred embodiment shown in FIG. 7, the saddle member 28 is replaced by a downwardly projecting tang 36 that generally conforms to the outer surface of the drainage line 8 or the circular boss 22. In FIG. 5, the U-clamp 26 passes directly through the apertures in support plate 32 and is bolted thereto. The U-clamp 26 can pass around the circular boss 22 or around the drainage pipe 84. For the purposes of this description the circular boss 22 is considered to be a part of the gate valve 16.

In another embodiment of the device (not shown), the support plate tang 36 can have a slot through it capable of receiving a hose clamp. The hose clamp is passed through the slot and around the circular boss 22 or the drainage pipe 8 so as to secure the support plate 36 to the drainage line 8 or the circular boss 22 thereby eliminating the U-bolts 26. It is also possible to extend the support tang 36 outward (sideways) beyond plate 32 and pass a clamp or other securing means around the projecting tang 36 and the drainage line 8. For the purposes of this invention, these and alternate fastening means are considered to be equivalent.

In yet another embodiment shown in FIGS. 5 and 6, it is possible to secure the support plate with one or more downwardly projecting tangs 33,35, and 37 that are secured directly to the gate valve 16 rather than to the circular boss 22 or drainage line 8. The downward projecting tangs 33, 35 and 37 are fastened to the gate valve 16 by means of suitable fasteners such as nuts 31 and bolts 39 passing through the gate valve 16.

In FIG. 2, the support plate 32 has a hydraulic cylinder tang 38 attached to it by means of suitable fasteners such as machine screws 40. The hydraulic cylinder 42 is comprised of a cylindrical housing 44, a hydraulic rod 46 that projects out of the center of one end of the cylindrical housing 44 and a hydraulic cylinder boss (tang) 48 that is secured to or a part of the hydraulic cylinder housing 44 at the end opposite the hydraulic rod 46. The hydraulic cylinder housing boss 48 has an aperture through it and is attached to the hydraulic cylinder tang 38 by pivoting means such as a pivot pin 50. The pivot pin passes through the apertures of the hydraulic cylinder tang and the hydraulic cylinder housing tang and is suitably secured by suitable means such as, for example, by an enlarged head at one end of the pivot pin 50 and a securing pin at the other end of the pivot pin 50. The hydraulic cylinder 42 also has a hydraulic line 52 that allows for the admission and release of hydraulic fluid into and out of the hydraulic cylinder 42.

A pivot arm 54 has a first end 56 and a second end 58. The first end 56 is secured to the hydraulic rod 46 by means of suitable aligning apertures in the hydraulic rod 46 and the end 56 of the pivot arm 54 and a pivoting means such as a pivot pin 62. The second end 58 of the pivot arm 50 is secured to the control rod 24 of the gate valve 16 by means of a collar 64 that has a tang 66 having an aperture in it that aligns with an aperture in the second end 58 of the pivot arm 54. A pivot pin 68 is passed through the apertures in the second end 58 of the pivot arm 54 and the collar tang 66 and secured b.: suitable means such as an enlarged head at one end of the pivot pin 68 and a securing pin such as a cotter or locking pin at the other end. The collar 64 may be secured to the control rod 24 by means of circular collars 70 and 72. Collar 70 is secured to the control rod 24 by means of a set screw 74. As seen in FIG. 3, collar 72 is secured to the control rod 24 by means of aligning apertures that pass through both the collar 72 and the control rod. A securing pin 76 passes through the apertures and secures the collar in place. Using this means of attachment, the pin 76 can be readily removed thereby releasing the collar 72 from the control rod 24 and allowing the collar 64 to the removed from the control

rod 24 in those instances where power is lost or the user is otherwise unable to control the hydraulic mechanism in its usual fashion. In such an instance, a handle 202 (FIG. 7) can be secured to control rod 24 and the gate valve 16 manually operated. Alternatively, collars 70 and 72 may both be secured to control rod 24 by means of set screws with the second end 58 of the pivot arm 54 being released from collar tang 66 by removing the securing pin (a pin such as pin 76 shown in FIG. 3) from the pivot pin 68 and removing pivot pin 68.

Returning to FIG. 2, the pivot arm 54 is secured to the support plate 32 by means of a connecting plate 130. The connecting plate 130 is secured to the pivot arm 54 by means of aligning apertures in the pivot arm and a first end 134 of the connecting plate 130. The apertures are secured with a pivot pin 132 and means for securing the pivot pin within the apertures. The second end 136 of connecting plate 130 is secured to the support plate tang 138 by means of aligning apertures that receive a pivot pin 140 which is suitably secured.

A switch 142 is secured to the gate valve 16 by means of an attaching arm 144 that is secured to the gate valve 16 by means of a machine screw 146. As the pivot arm 54 moves the gate valve rod 24 into the closed position, the pivot arm contact flange 148 makes contact with switch 142 causing an indicator light 88 to be turned either on or off. Preferably, the light is off when the gate 21 is in the closed position and comes on as the pivot arm contact flange 148 disengages switch 142 as the gate 21 is opened.

FIG. 4 illustrates the hydraulic and electrical control system by which the hydraulics are operated. Typically, the electrical system operates off of the recreational vehicle 6 battery 152. Hydraulic cylinder 170 is operated by switch 154 while hydraulic cylinder 180 is operated by switch 172. Switches 154 and 172 are three position switches such as a rocker-type switch that is disconnected in its center or second position.

In the first position of switch 154, motor 156 is activated by closing the circuit to electrical connector 158. Solenoid 160 is also activated through electrical connector 162. Solenoid 160 causes valve 164 to open. With valve 164 open, the motor 156 drives pump 166 which causes hydraulic fluid to flow from reservoir 168 to the hydraulic cylinder 170 forcing the cylinder rod 186 out of the hydraulic cylinder 170. When switch 154 is set to its third position, solenoid 160 is activated again opening valve 164. Motor 156 is also activated but this time in a reversing mode which causes hydraulic fluid to be returned from hydraulic cylinder 170 through the pump 166 and into reservoir 168 thereby causing the hydraulic rod 186 to be withdrawn into the hydraulic cylinder 170.

Switch 172 is shown in its second or disconnect position with solenoid 174 in the closed position. When such switch 172 is moved to its first position, solenoid 174 causes valve 176 to open as a result of a connection through connector 178. In the first position, motor 156 is caused to operate in a forward position, causing pump 166 to pump hydraulic fluid from reservoir 168 through valve 176 into hydraulic cylinder 180 causing hydraulic cylinder rod 182 to move out of the hydraulic cylinder 180. When switch 172 is allowed to return to its open position, solenoid 174 closes valve 176 thereby maintaining fluid in hydraulic cylinder 180 and the rod 182 in a fixed position. When the switch 172 is moved to its third position, the solenoid 174 opens valve 176 and the motor 156 operates in a reverse manner causing pump 166 to withdraw hydraulic fluid from hydraulic cylinder 180 and return it reservoir 166 thereby causing hydraulic cylinder rod 182 to be withdrawn into the hydraulic cylinder 180 thereby opening gate valve 16.

The position of the gate 21 in the gate valve 16 can be shown by means of indicator lights 188 and 190, each being used with a separate hydraulic cylinder. The indicator lights 188 and 190 are used in conjunction with contact switches 192 and 194, respectively. As illustrated, the contact switch would normally cause the lights 188 and 190 to be in the "on" position when the gate valve is open such as is shown in FIG. 2. When the pivot-arm contact plate 148 disengages from switch 142 as when the gate is in the opened position, switch 142 is closed causing current to flow and the indicator light to be activated.

In FIG. 4, cylinder rods 182 and 186 relate to cylinder rod 46 in FIGS. 2 and 7, switches 154 and 172 relate to switches 82 and 84 or 92 and 94 in FIG. 1, lights 188 and 190 relate to lights 86 and 88 in FIG. 1, and switches 192 or 194 relate to switch 142 in FIGS. 2 and 7.

FIG. 7 illustrates some additional refinements that may be incorporated into this invention. Tang 204 rests on the edge of gate valve 16 to provide additional stability and ease of assembly when mounting the hydraulic mechanism 20 on the drainage line 8 or circular boss 22. Switch tang 206 (see also FIGS. 5 and 6) provides a convenient mounting location for switch 142. For additional mechanism stability, a clevis can be formed at the first end 56 of the pivot arm 54 so that the legs 208 of the clevis receive the end of the hydraulic rod 46 between them. Tang 210 can be cast as an integral part of support plate 32. In addition, a pair of tangs 210 can be provided so as to receive the hydraulic cylinder tang 48 between them. Tang 212 may also be cast as an integral part of support plate 32. A pair of tangs 212 may be used with a pair of connecting plates 130 that are placed on each side of pivot arm 54. When a pair of connecting plates 130 are used, bosses 214 cast as a part of pivot arm 54 (or separate sleeves) are used so that a sufficient distance is provided between plates 130 so that they do not contact switch tang 206 or switch 142.

It is possible that changes in configurations to other than those shown could be used but that which is shown if preferred and typical. Without departing from the spirit of this invention, various means of fastening the components together may be used.

It is therefore understood that although the present invention has been specifically disclosed with the preferred embodiment and examples, modifications to the design concerning sizing and shape may be apparent to those skilled in the art and such modifications and variations are considered to be within the scope of the invention and the appended claims.

What is claimed is:

1. An external hydraulic device for operating a gate valve in a drainage line of a holding tank of a recreational vehicle comprising:

a. a support plate;

b. means for fastening said support plate to said drainage line

c. a hydraulic cylinder comprising a housing and a hydraulic rod;

d. means for attaching said hydraulic cylinder housing to said support plate;

e. a pivot arm having a first and second end and a pivoting means therebetween:

f. means for securing said pivot arm at said first end to said hydraulic rod;

g. means for securing said pivot arm at said second end to a control rod of said gate valve;

h. means for securing said pivoting means of said pivot arm to said support plate; and

i. means for operating said hydraulic cylinder.

2. The hydraulic device for operating a gate valve according to claim 1 wherein said means for fastening said support plate to said drainage line is a U-bolt passing around said drainage pipe and passing through aligning holes in said support plate with means for attaching said U-bolt to said support plate.

3. The hydraulic device for operating a gate valve according to claim 2 wherein said means for attaching said U-bolt to said support plate is a nut.

4. The hydraulic device for operating a gate valve according to claim 1 with said support plate further compromising a downwardly projecting support tang having a surface conforming to a portion of said drainage line.

5. The hydraulic device for operating a gate valve according to claim 1 wherein said means for attaching said hydraulic cylinder to said support plate is a pivoting means.

6. The hydraulic device for operating a gate valve according to claim 5 with said pivoting means comprising a tang extending upward from said support plate with an aperture therein arranged so as to align with an aperture in a boss at an end of said hydraulic cylinder so as to receive a pivot pin therethrough.

7. The hydraulic device for operating a gate valve according to claim 1 with said means for securing said pivot arm to said hydraulic rod comprising an aperture in said first end of said pivot arm aligning with an aperture in an end of said hydraulic rod so as to receive a pivot pin therethrough.

8. The hydraulic device for operating a gate valve according to claim 1 with said means for securing said pivot arm to said support plate comprising:

a. a pivot arm tang projecting from said support plate and having an aperture therein;

b. a pivot plate having a first and a second end with said first end having an aperture therein aligning with said pivot arm tang aperture so as to receive a pivot pin therethrough and said second end of said pivot plate pivotally joined to said pivoting means of said pivot arm.

9. The hydraulic device for operating a gate valve according to claim 8 with said pivoting means of said pivoting arm comprising an aperture formed in said pivoting arm and aligning with an aperture in said second end of each said pivot plate so as to be pivotally joined thereto by means of a pivot pin.

10. The hydraulic device for operating a gate valve according to claim 1 with said means for operating said hydraulic cylinder comprising a hydraulic pump connected to said hydraulic cylinder by a hydraulic line and means for operating said hydraulic pump.

11. The hydraulic device for operating a gate valve according to claim 10 wherein said means for operating said hydraulic pump is an electric motor and switch means for operating said motor.

12. The hydraulic device for operating a gate valve according to claim 11 with said switch means comprising a switch located at a remote site.

13. The hydraulic device for operating a gate valve according to claim 11 wherein said electric motor is a reversing motor.

14. The hydraulic device for operating a gate valve according to claim 13 further comprising a control valve for controlling the amount of hydraulic fluid in said hydraulic cylinder so as to hold the gate valve in any position.

15. The hydraulic device for operating a gate valve according to claim 14 further comprising a solenoid for opening and closing said hydraulic fluid control valve and switch means for operating said solenoid.

16. The hydraulic device for operating a gate valve according to claim 1 further comprising indicating means for indicating a position of said gate valve.

17. The hydraulic device for operating a gate valve according to claim further comprising a disconnect means whereby said hydraulic cylinder is disconnected from said gate valve for manual operation of said gate valve.

18. A hydraulic device for opening, closing or holding a holding-tank gate valve in any position wherein said gate valve is located in a passage connected to a holding tank of a recreational vehicle and comprising:

a. a hydraulic cylinder comprising a housing and a hydraulic rod projecting therefrom;

b. means for connecting said hydraulic rod to a gate of said gate valve; and

c. hydraulic means for controlling the position of said hydraulic rod into or out of said hydraulic cylinder comprising a hydraulic pump for pumping a fluid into or out of said hydraulic cylinder housing so as to cause said hydraulic rod to move into or out of said cylinder housing.

19. The hydraulic device for opening, closing or holding a holding-tank gate valve in any position according to claim 19 with said means for controlling the position of said hydraulic rod into or out of said hydraulic cylinder further comprising:

a. a motor for operating said hydraulic pump and

b. switch means for operating said motor.

20. The hydraulic device for opening, closing or holding a holding-tank gate valve in any position according to claim 19 with said means for controlling the position of said hydraulic rod into or out of said hydraulic cylinder further comprising a valve for maintaining varying amounts of hydraulic fluid in said hydraulic cylinder.

21. The hydraulic device for opening, closing or holding a hold-tank gate valve in any position according to claim 20 with said means for controlling the position of said hydraulic rod into or out of said hydraulic cylinder further comprising a solenoid for operating said hydraulic fluid maintaining valve.

22. The hydraulic device for opening, closing or holding a holding-tank gate valve in any position according to claim 19 wherein said motor is a reversing motor.

23. The hydraulic device for opening, closing or holding a holding-tank gate valve in any position according to claim 19 with such switch means comprising means for operating said motor in either a forward or reverse direction.

24. The hydraulic device for opening, closing or holding a holding-tank valve in any position according to claim 19 with said switch means comprising means for operating said motor from a remote location.

25. The hydraulic device for opening, closing or holding a holding-tank gate valve in and position according to claim 18 further comprising a disconnect means whereby said hydraulic cylinder can be disconnected from said gate valve for manual operation of said gate valve.

26. The hydraulic device for opening, closing or holding a holding-tank gate valve in any position according to claim 18 further comprising an indicating means for showing the position of said gate valve.

27. The hydraulic device for opening, closing or holding a holding-tank gate valve in any position according to claim 26 wherein said indicating means is a light.

28. An external hydraulic device for operating a gate valve in the drainage line of a holding tank of a recreational vehicle comprising:

a. a support plate;
b. means for fastening a support plate on the outside of a housing of said gate valve;
c. a hydraulic cylinder comprising a housing and a hydraulic rod;
d. means for attaching said hydraulic cylinder housing to said support plate;
e. a pivot arm having a first and a second end and a pivoting means therebetween;
f. means for securing said pivot arm at said first end to said hydraulic rod;
g. means for securing said pivot arm at said second end to a control rod of said gate valve;
h. means for securing said pivoting means of said pivot arm to said support plate; and
i. means for operating said hydraulic cylinder.

* * * * *

United States Patent [19]

Boomgaarden

US005244003A

[11] **Patent Number: 5,244,003**

[45] **Date of Patent: Sep. 14, 1993**

[54] **TELESCOPIC DRAIN HOSE**

[75] Inventor: **Steven L. Boomgaarden**, Rosemount, Minn.

[73] Assignee: **Tennant Company**, Minneapolis, Minn.

[21] Appl. No.: **870,094**

[22] Filed: **Apr. 16, 1992**

Related U.S. Application Data

[63] Continuation of Ser. No. 642,654, Jan. 17, 1991, abandoned.

[51] **Int. Cl.**[5] **E03B 1/00**

[52] **U.S. Cl.** **137/1**; 137/355.16; 137/590; 137/899; 15/320; 15/353

[58] **Field of Search** 15/320, 353; 137/355.12, 355.16, 590, 577, 577.5, 899, 1

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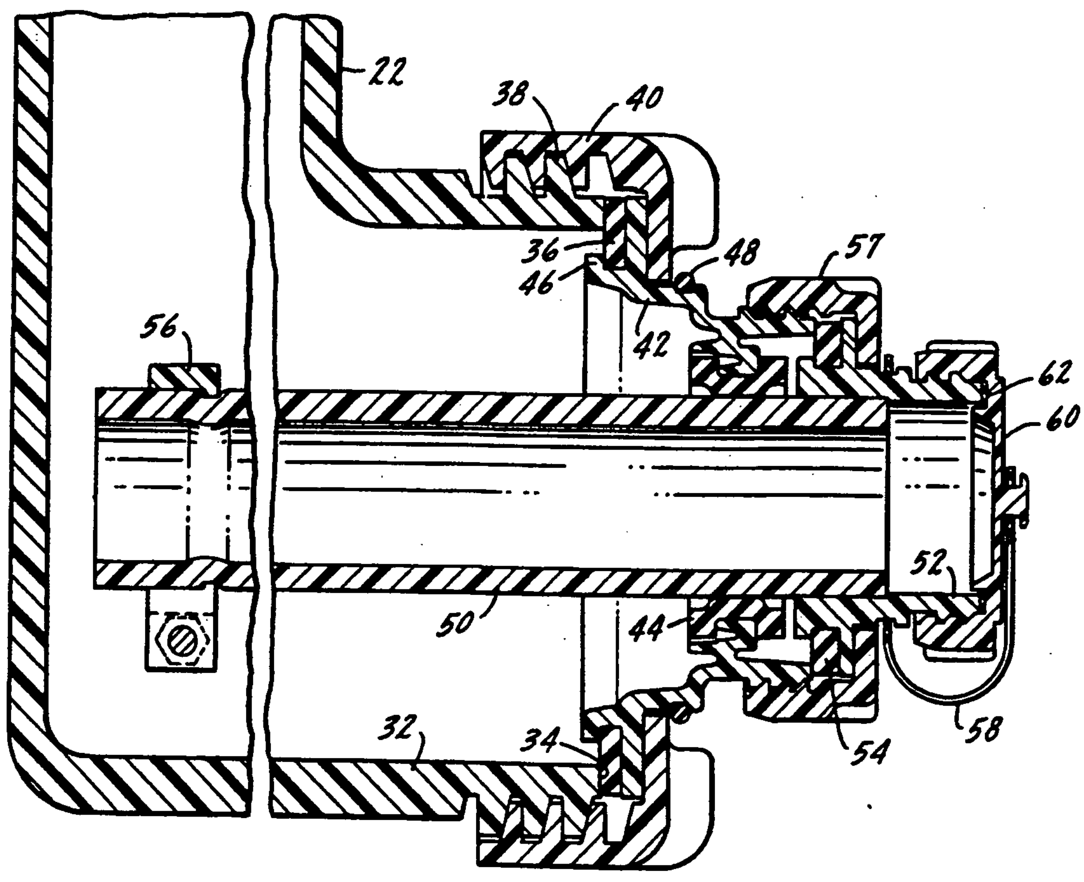
Primary Examiner—A. Michael Chambers
Attorney, Agent, or Firm—Kinzer, Plyer, Dorn, McEachran & Jambor

[57] **ABSTRACT**

This is a drain hose for a tank such as on a floor scrubbing machine and a means for attaching it to the tank. When not in use the hose is stored inside the tank, where it is protected from damage such as may occur to externally stored hoses. When it is to be used the hose is pulled from the tank and extended to a suitable site such as a floor drain and the contents of the tank are emptied through it. After use the hose may be pushed back into the tank again. The means for attaching the hose to the tank may include a cover over an opening in the tank which is amply large to permit cleaning out the tank.

11 Claims, 4 Drawing Sheets



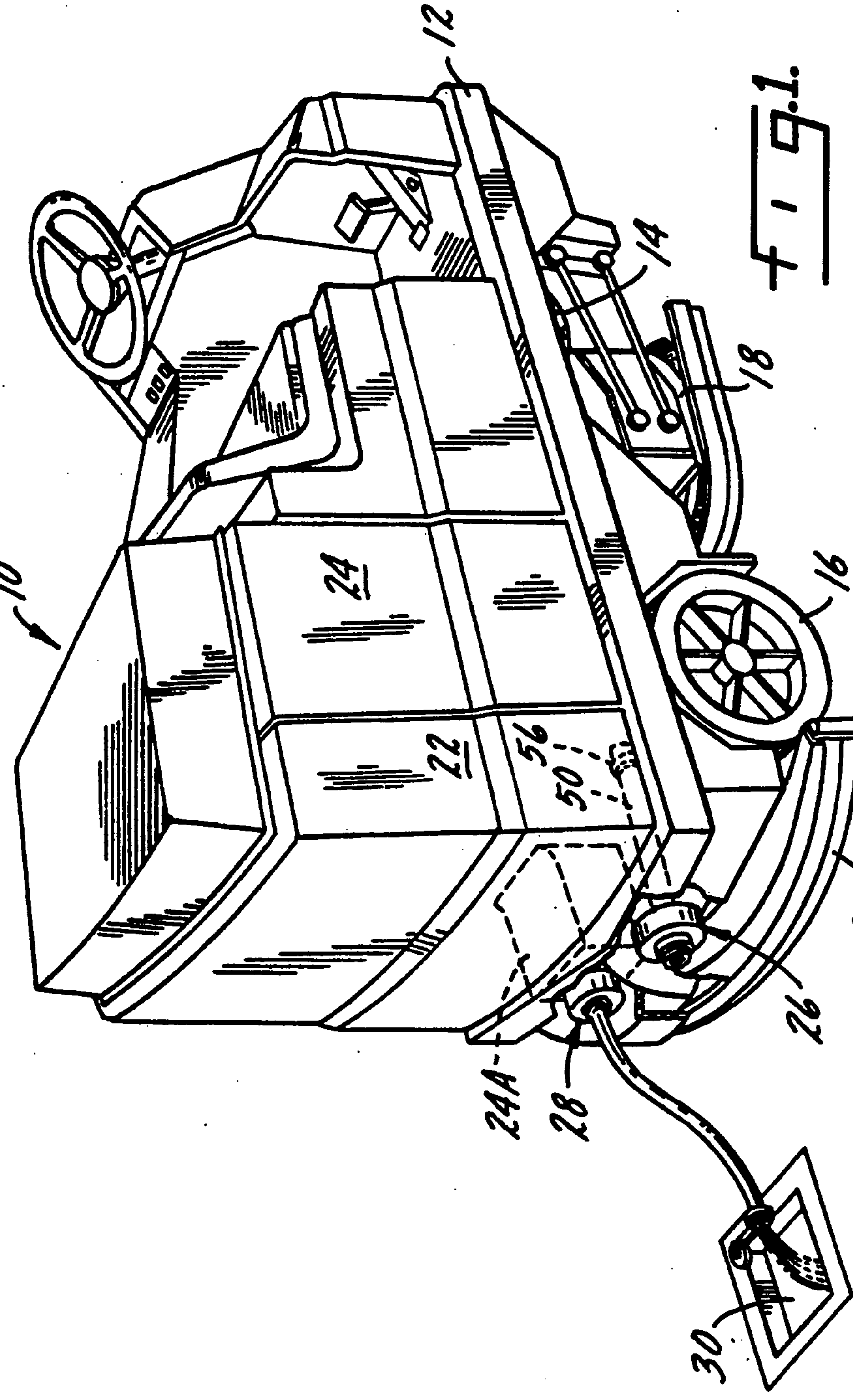
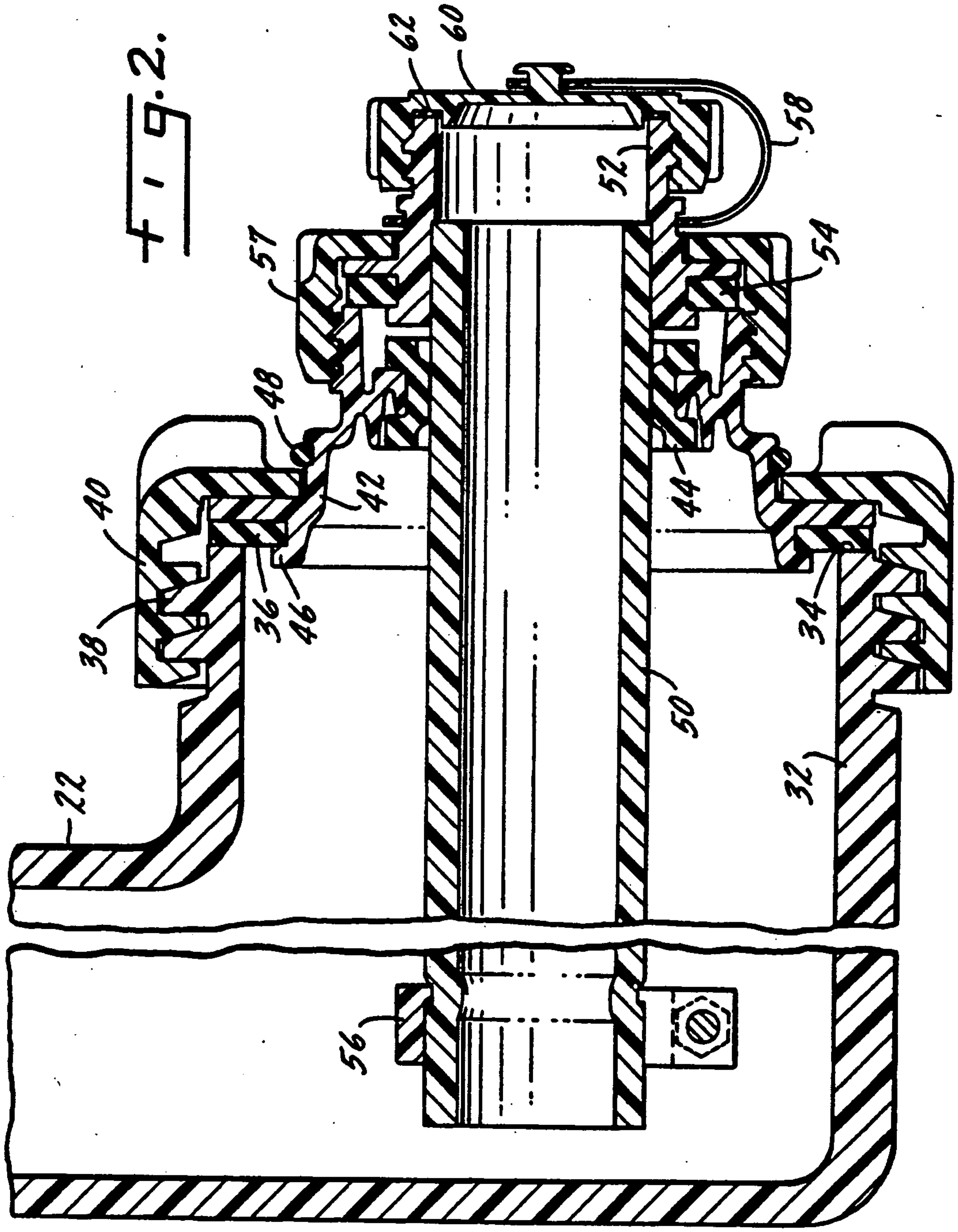


Fig. 1.

Fig. 2.



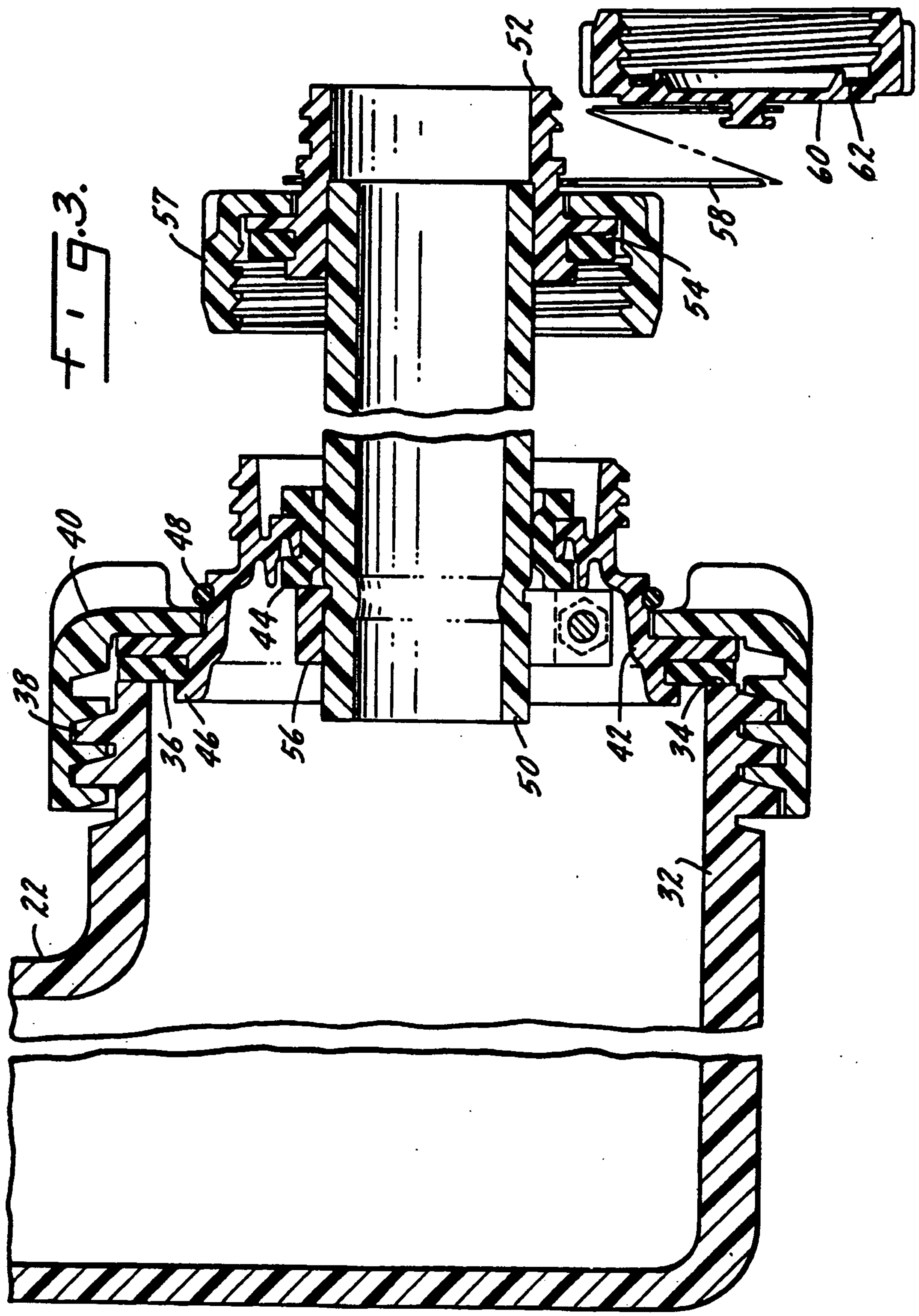


Fig. 3.

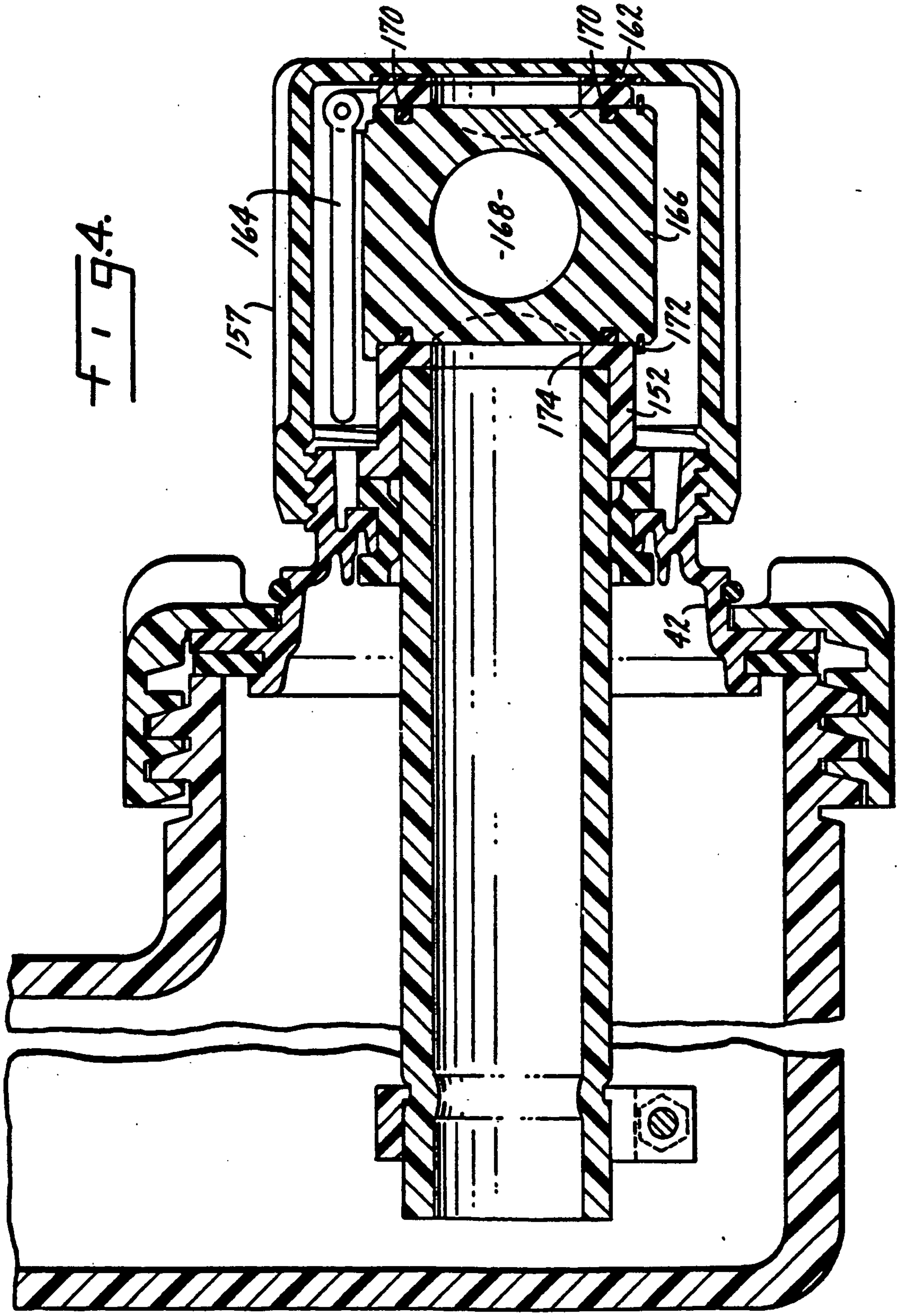


Fig. 4.

TELESCOPIC DRAIN HOSE

This is a continuation of copending application Ser. No. 07/642,654 filed on Jan. 17, 1991 now abandoned.

BACKGROUND OF THE INVENTION

It is often necessary to empty a tank by connecting a drain hose to it and running that hose to a floor drain or other acceptable drain site. An example of where this occurs might be in connection with the use of a floor scrubbing machine such as is found in U.S. Pat. No. 5,016,310. Such scrubbers carry tanks for holding clean scrubbing solution before it is applied to a floor and soiled solution picked up from a floor that has been scrubbed. A problem sometimes arises as to where to store a drain hose between uses, and in floor scrubbers this has been especially true. There seems to be no good place to put them. In the past they have been secured to the outside of the machine with spring clips, but the clips get bent out of shape easily and the hoses are subject to damage from bumping nearby objects as the machine moves around. Commonly one end of a hose is permanently attached to a drain fitting at the bottom of a tank and for storage its free end is elevated above the liquid level in the tank to prevent dribbling out of the end of the hose between uses. In the case of soiled scrubbing solution recovered from a floor the suspended dirt in the liquid tends to settle in the bend where the hose curves upward and the hose may become plugged. Then a steel rod pushed into the hose to clear it may punch a hole in it. In general it has been a situation begging for improvement.

SUMMARY OF THE INVENTION

The invention comprises a drain hose for a tank, a means of storing it within the tank between uses, and a means for pulling it out when it is desired to drain the tank. The hose has a suitable diameter for draining the related tank in a reasonable time into a suitable drain site, e.g. a floor drain. It is made of a flexible material such as vinyl, and has a smooth outer surface. The tank has a round drain opening at the bottom of a side wall which is large enough to permit cleaning out the tank. The drain opening has a cover with a hole in it that is fitted with a resilient circular seal which matches the outside diameter of the hose. The hose may be pushed through this seal into the tank for storage, or pulled out for use, without leakage around the hose. Means are provided to stop the hose travel when it has been pulled out to its maximum distance, and means are provided to secure the hose from being inadvertently pulled out when it is stored inside the tank. A closure is also provided for closing off the free end of the hose while it is in storage or is being pulled out of the tank to a desired position at a drain site such as a floor drain. At that time it can be opened by opening the closure, which may be an end cap or optionally a valve on the end of the hose, to drain the tank. The invention solves the problem of where to store the hose and protects it against damage while in storage. There is no upward curvature of the hose in storage, so dirt does not tend to collect in it, and therefore problems associated with cleaning it are avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a floor scrubbing machine which makes use of the present invention.

FIG. 2 is a vertical section taken through a tank outlet and drain hose with the hose in retracted or storage position.

FIG. 3 is a vertical section similar to FIG. 2 but with the hose in extended or use position.

FIG. 4 is a vertical section similar to FIG. 2 showing an alternative construction of the invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

FIG. 1 shows an industrial floor scrubbing machine, commonly referred to as a scrubber, and generally designated by the number 10. It utilizes the present invention, which will be described in detail. In all other respects, however, it may be a conventional scrubber. It has a frame 12 which supports the various machine components. It is supported by a single front wheel, partially shown at 14, which is powered and steerable. Two rear wheels 16 (only one shown) support the rest of the weight. It may be powered by batteries and electric motors. Clean scrubbing solution is carried in a solution tank 22 and dispensed to the floor while a scrub head 18 mounted amidships provides two powered rotating scrub brushes which do the actual work of scrubbing the floor. A vacuum pickup squeegee 20 removes soiled scrubbing solution from the floor and deposits it in a recovery tank 24 for later disposal.

Tanks 22 and 24 are preferably made of plastic, and may be rotationally molded. Means are provided at the rear of the machine to drain both tanks, and these means are the subject of this patent. There are two tank drains, shown generally at 26 and 28. Drain 26 connects to and drains the solution tank 22. Drain 28 connects to and drains the recovery tank 24 through an extended portion of tank 24 shown in dotted outline as 24A. This extension is an integral part of recovery tank 24 which passes under a raised bottom portion of solution tank 22 so that both drain ports may be located at the rear of the machine where they will be conveniently accessible.

As explained earlier in the "Summary of the Invention", the means which are provided for draining the tanks comprise flexible hoses which may be stored within the tanks when not in use, or pulled out when needed. As illustrated in FIG. 1, the drain hose for the recovery tank 24 is extended and the contents of tank 24 are being drained into a floor drain 30. Also in FIG. 1 the drain hose for the solution tank 22 is shown in its retracted or storage position. The hose is shown only in dotted outline in FIG. 1 because it is within the tank, but a detailed description will be given by reference to FIGS. 2 and 3. The two drains are essentially alike, and so only one will be described. We have elected the solution tank drain 26 for this.

Referring now to FIG. 2, there is shown a typical tank which may be considered to be the solution tank 22 of the scrubber shown in FIG. 1. However, it could also be some other tank, for the invention is applicable to many tanks other than the one illustrated. A circular outlet port 32 is provided at the bottom of one side wall of the tank as an integral part of the tank. It has an inside diameter large enough to facilitate any cleaning out of the tank that may be required from time to time. In the scrubber application an inside diameter of about five inches was found to be adequate. The outlet port 32 has a square face 34 to receive a sealing gasket 36 and external threads 38 which may advantageously be of buttress form. These threads receive a screw-on tank cap 40, which holds the rest of the parts to the tank.

An insert cover 42 has a circular hose seal 44 inserted into the round hole at its center and sealing gasket 36 is snapped over its inner flange 46. Tank cap 40 is slipped over insert cover 42 as shown and loosely secured with o-ring 48.

Drain hose 50 may be made of extruded vinyl. It has an inside diameter large enough to drain the tank in an acceptable time. For the scrubber a 1.25-inch i.d. was adequate, and the o.d. was 1.73 inches. It is solvent bonded to hose adapter 52 which has lid gasket 54 snapped over its inner flange. Hose 50 is pushed through hose seal 44 and hose clamp 56 is tightened around it near its end. When the hose is in storage position as shown in FIG. 2 it is retained by drain hose cap 57, and lid gasket 54 provides redundant assurance that there will be no leakage around the hose 50 in case hose seal 44 should leak.

A closure is needed to close the end of the hose, and hose cap 60 is one form of closure that may be used. An alternative form will be described later. Cap gasket 62 is cemented to the inner surface of cap 60 and seals against hose adapter 52 when hose cap 60 is screwed on tightly. A flexible tether 58 has a hole at one end large enough to snap over and fit loosely around the outer flange of hose adapter 52 and a small hole at the other end which snaps over and fits loosely around a button at the center of hose cap 60. The tether 58 serves the dual functions of loosely retaining drain hose cap 57 and preventing hose cap 60 from being misplaced when it is removed to drain the tank.

The gaskets, seal, o-ring and tether are made of an elastomeric material which is compatible with the contents that will be placed in the tank. Other parts are a suitable molded plastic.

The same parts are shown in FIG. 3 as in FIG. 2, but in FIG. 3 the hose 50 has been pulled out of the tank 22 and the end closure 60 has been removed from the hose adapter 52. There is thus an open passageway through the hose for the contents of the tank to drain out. This would be done when it is desired to drain the tank to a drain site such as floor drain 30 in FIG. 1.

The sequence of events would be first to unscrew drain hose cap 57 from insert cover 42. Then by grasping either cap 57 or cap 60, pull out the drain hose 50 until the hose clamp 56 bumps against hose seal 44. This gives the maximum distance that the hose can be pulled out; obviously it can be pulled out for only part of that distance if desired. The end of the hose is then positioned over the drain site and the end closure, hose cap 60, is unscrewed from the hose adapter 52. The tank contents will then flow to the drain site. After draining, reversing the above procedure will stow the hose back in the tank.

It should be noted that tank cap 40 can be unscrewed whether the hose is in or out of the tank, and the hose and all its related parts can be removed from the tank. This will give unrestricted access to the outlet port 32 for cleaning out sediment or other solid material in the tank. Such tools as a long handled scraper and a garden hose are typically used for this when necessary.

When the drain hose is in position over a drain site and the hose cap 60 is removed there will be a rush of liquid from the tank which may wet the hand of the person doing the job. With some liquids that may be undesirable. FIG. 4 shows an alternative construction which can be used to avoid this. In FIG. 4 the parts are all the same as in FIG. 2 except those that are numbered. It will be seen that hose adapter 52 of FIG. 2 has been replaced with a modified hose adapter 152 which incorporates the body for a conventional plug valve. A new cover 157 with cover gasket 162 cemented into it is screwed to insert cover 42 to cover the entire area and provide redundant protection against leakage when the hose is in stored position. This cover is removed for tank draining. A person can then grasp hose adapter 152 and pull the hose out to the drain site. One can then grasp hinged valve handle 164, swing it clockwise 180 degrees, and twist it to turn the valve plug 90 degrees from its position as shown in FIG. 4. This will move the hole 168 in valve plug 166 from the position shown to a position in line with the horizontal bore 174 of the valve body. The liquid will then drain out freely, and the operator will not have had to put his or her hand in the stream. O-rings 170 seal valve plug 166 in the transverse bore of valve body 152 and retaining ring 172 retains the plug in the body after the manner of conventional plug valves. Of course, it will be appreciated by anyone versed in the art that the valve arrangement described here is only one of many different valves which could be used to achieve the end.

With these and other variations in mind it is desired that the inventive subject matter be unrestricted except by the appended claims

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of storing and using a flexible drain hose for a liquid containing tank on a floor scrubber whereby the hose when not in use is stored within the tank, and when in use the hose may be withdrawn from the tank and may be bent as needed to direct it to a suitable drain site into which the contents of the tank may be emptied, the hose being continuously connected to the tank during storage, withdrawal and use in a manner which permits liquid from the tank within the hose while preventing the escape of liquid from the tank around the outside of the hose.

2. The method of claim 1 for storage and use of a drain hose for a liquid containing tank in which a closure is provided for one end of the hose, said closure being a cap.

3. The method of claim 1 for storage and use of a drain hose for a liquid containing tank in which the drain outlet of the tank where the drain hose is connected is at or near the bottom of a side wall of the tank.

4. The method of claim 1 for storage and use of a drain hose for a liquid containing tank in which the means of connecting the hose to the tank also provides an opening into the tank, said opening being of adequate size to permit cleaning out the tank.

5. The method of claim 1 for storage and use of a drain hose for a liquid containing tank in which a closure is provided for one end of the hose, said closure being a valve.

6. A floor scrubbing machine having at least one tank to contain liquid scrubbing solution, a flexible drain hose for each tank, each tank and its related hose being so constructed that the hose when not in use is stored within the tank, and when in use the hose may be withdrawn from the tank and may be bent as needed to direct it to a suitable drain site into which the contents of the tank may be emptied, the hose being continuously connected to the tank during storage, withdrawal and use in a manner which permits liquid from the tank within the hose while preventing the escape of liquid from the tank around the outside of the hose.

7. In a drain arrangement for a tank on a floor scrubber constructed and arranged to hold a liquid, an opening at the bottom of the tank, a flexible drain hose in the opening constructed and arranged for axial movement between an inner stored position in which it is substantially completely within the tank and an extended drain position in which its outer end extends a substantial distance from the tank, and a cap on the outer end of the drain hose adapted to be removed so that the liquid content of the tank may be drained out through the hose when the cap is removed.

8. The structure of claim 7 further characterized by and including a manually operable valve on the outer end of the drain hose to control the flow of liquid through the drain hose.

9. The structure of claim 7 further characterized by and including a manually operable holder for the outer end of the hose constructed and arranged to releasably hold the hose in its inner position and, upon release, to allow the hose to be manually withdrawn to its extended position.

10. The floor scrubber drain arrangement of claim 7 further characterized by and including a stop member on the innermost end of said hose, and means associated with said opening cooperating with said stop member to prevent complete removal of said hose from said tank.

11. The floor scrubber drain arrangement of claim 10 further characterized in that said means associated with said opening is removably attached to said opening to provide for the removal thereof and the complete removal of said hose from said tank.

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US005247974A

United States Patent [19]

Sargent et al.

[11] **Patent Number: 5,247,974**

[45] **Date of Patent: Sep. 28, 1993**

[54] **PNEUMATIC SEALING DEVICE FOR WASTE DISPOSAL SYSTEMS**

[75] Inventors: **Charles L. Sargent; John M. Antos,** both of Ann Arbor; **George Grech,** Garden City, all of Mich.

[73] Assignee: **Thetford Corporation,** Ann Arbor, Mich.

[21] Appl. No.: **823,356**

[22] Filed: **Jan. 21, 1992**

[51] **Int. Cl.**[5] **E03D 1/00**

[52] **U.S. Cl.** **141/287;** 141/312; 141/382; 417/478; 137/899; 4/321; 4/323; 285/97

[58] **Field of Search** 141/93, 287, 312, 368, 141/382, 383, 392; 4/321, 323; 417/478; 277/34, 34.3; 285/97, 107; 137/355.16, 899

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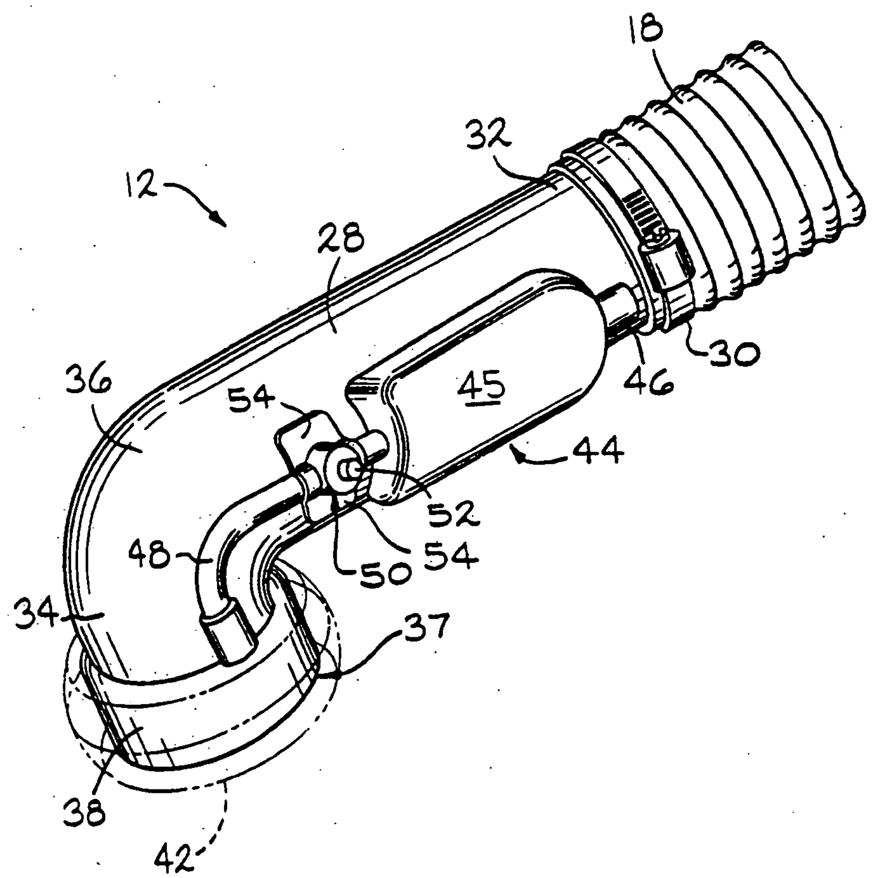
Primary Examiner—Henry J. Recla
Assistant Examiner—Casey Jacyna
Attorney, Agent, or Firm—Harness, Dickey & Pierce

[57] **ABSTRACT**

A temporary sealing device for sealing a waste discharge conduit from an RV to an inlet receptacle of a waste receiving reservoir. The sealing device includes an inflatable bladder which is mounted so as to be positionable between the discharge conduit and the receptacle. A pump inflates the bladder to a size which seals the opening between the receptacle and the conduit to inhibit removal of the conduit and prevent the discharge of waste therearound. The sealing device is also provided with a valve which allows the bladder to be deflated after the transfer of waste and permits the conduit to be withdrawn from the receptacle.

7 Claims, 3 Drawing Sheets



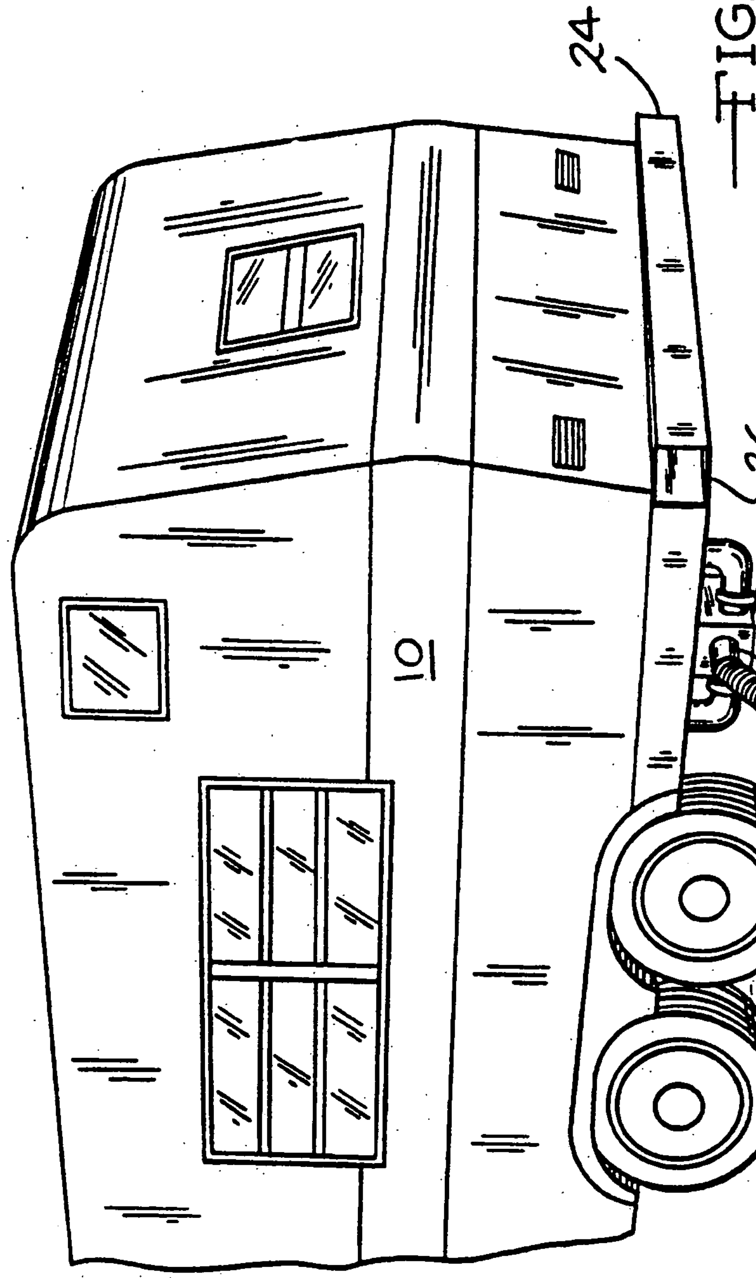


FIG. 1

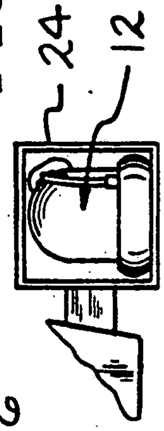


FIG. 2

FIG. 3

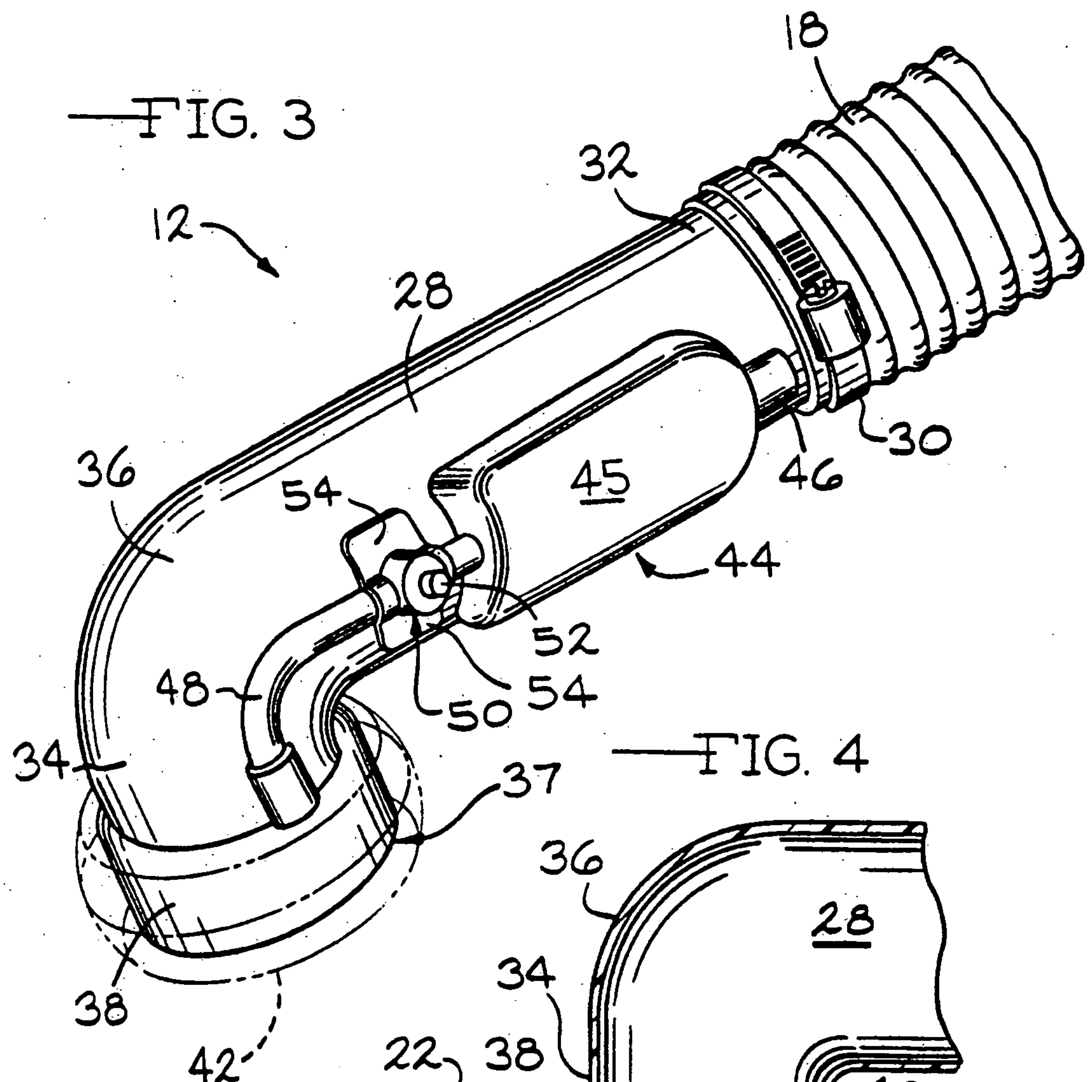

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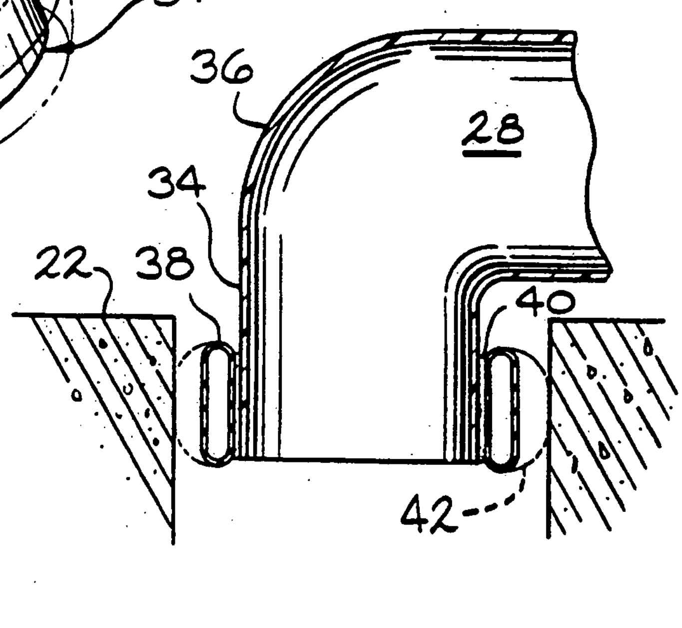
FIG. 4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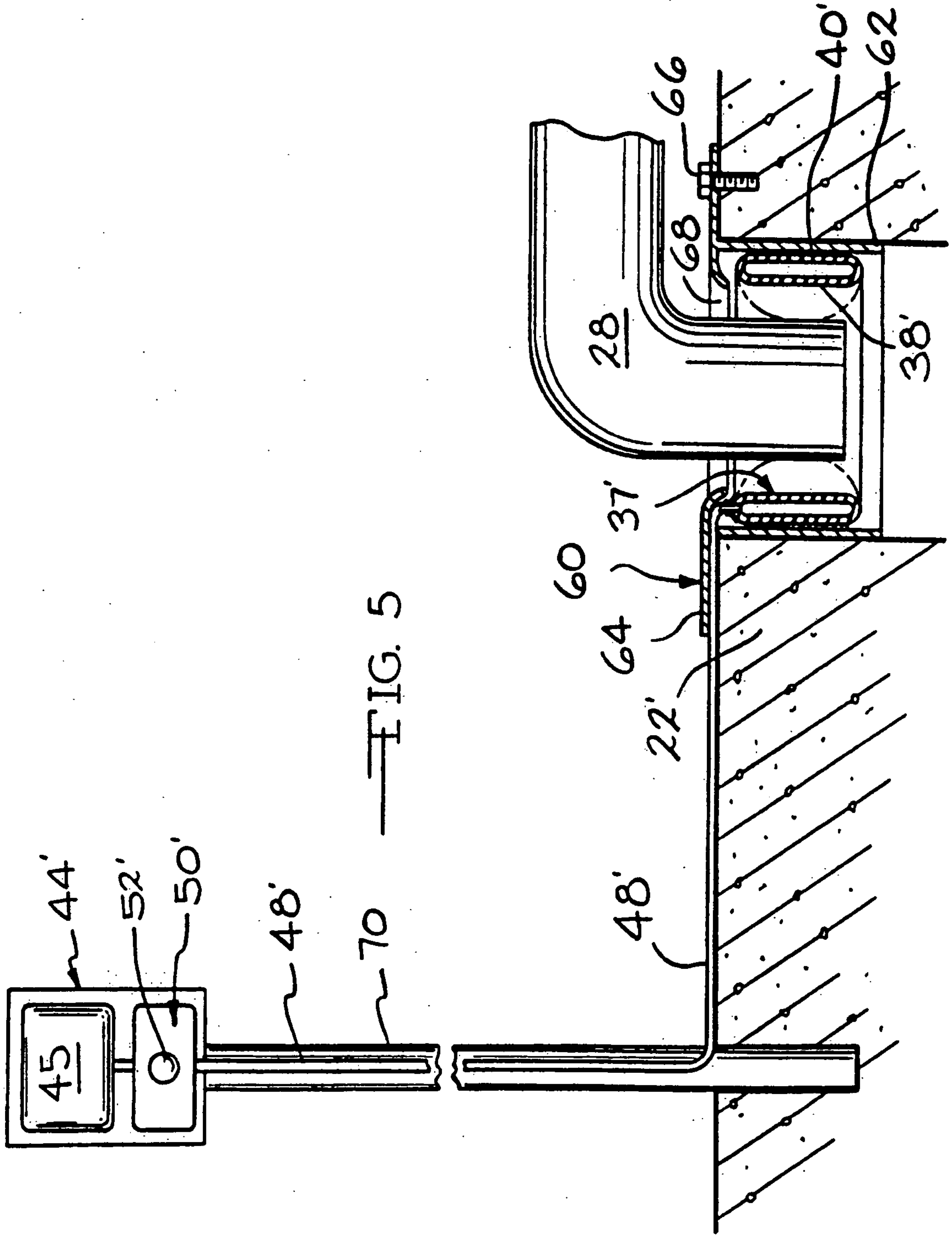

FIG. 5

PNEUMATIC SEALING DEVICE FOR WASTE DISPOSAL SYSTEMS

BACKGROUND AND SUMMARY OF THE INVENTION

The invention relates to a sealing device for temporarily sealing a hose to a drain. More particularly, the invention has application for sealing a hose from a waste disposal system of a recreational vehicle to an inlet receptacle of a waste receiving station.

One of the most appalling aspects involved with using a recreational vehicle (RV) is discharging waste from a holding tank of the vehicle into the waste reservoir of an RV sanitation station. Ordinarily, this is accomplished by manually attaching one end of a hose to a discharge outlet of the RV waste holding tank and manually attaching the opposing end of the hose to the inlet receptacle of the waste station or reservoir. Because inlet receptacles at different dump stations may vary in size, the RV operator often must additionally attach, to the outboard end of the hose, an adapter corresponding to the particular inlet receptacle size. Among the limitations of this system is that the method is labor intensive, messy and potentially unsanitary.

With the limitations of the prior art in mind, it is an object of this invention to provide a temporary sealing device which eliminates the need for numerous adapters for the various diameters of inlet receptacles.

It is another object of the present invention to provide a temporary sealing device which will readily secure the waste hose to the inlet receptacle and inhibit its withdrawal while waste is being discharged from the RV.

An additional object of this invention is to provide a temporary sealing device which will likewise inhibit the escape of odorous gas from the dump station between the inlet receptacle and the coupling itself during the discharging of waste.

It is further an object of this invention to provide a coupling which can be readily retrofitted into existing RV waste disposal systems.

In achieving the above objects, the temporary sealing device is provided having an inflatable cuff or bladder. In one embodiment, the outboard end of a discharge hose is attached to a coupling, while the outlet end of the coupling is provided with the bladder on its exterior surface. The outlet end of the coupling is then inserted into the inlet receptacle of the waste dump reservoir so that the bladder is situated within the interior of the inlet receptacle. A pump, provided on the coupling, supplies fluid for inflating the bladder. When inflated, the bladder circumferentially engages the interior of the inlet receptacle and thereby forms a seal between the inlet receptacle and the discharge end of the coupling. Waste may now be transferred from the holding tank of the RV through the hose to the waste dump reservoir.

After the waste has been transferred from the holding tank, the coupling is disengaged from the inlet receptacle by deflating the bladder. A pressure release valve allows the bladder to deflate under forces induced by its own resiliency. The coupling is then removed from the inlet receptacle and the hose and coupling are appropriately stored until their use is again required.

In a second embodiment, the inflatable bladder is provided on the inlet receptacle of the waste dump reservoir. The outlet end of the coupling is inserted into the inlet receptacle so that the bladder encircles therearound. A pump, provided at the dump station, supplies fluid to the bladder for inflation. When inflated, the bladder circumferentially engages the exterior of the coupling and thereby forms a temporary seal between the discharge end of the coupling and the inlet receptacle. Similar to the first embodiment, the coupling is disengaged from the bladder and the inlet receptacle by deflating the bladder through use of a pressure release valve.

The invention thus provides a temporary sealing device which reduces the manual labor involved with attaching the discharge hose, eliminates the need for adapters and prevents the discharge of waste onto the exterior of the waste receiving reservoir where it would be objectionable and present a sanitary hazard.

Additional benefits and advantages of the present invention will become apparent to those skilled in the art to which this invention relates from the subsequent description of the preferred embodiments and the appended claims, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates one embodiment of the present invention being utilized to connect the waste holding tank of a recreational vehicle with the inlet receptacle of a waste dump reservoir;

FIG. 2 is a side elevational view of a stored coupling embodying the principles of the present invention;

FIG. 3 is a perspective view of a coupling embodying the principles of the present invention with the inflated bladder being shown in phantom lines;

FIG. 4 is a sectional view taken substantially along line 4—4 in FIG. 1 illustrating one embodiment of the invention being inserted into an inlet receptacle of a waste receiving reservoir; and

FIG. 5 is a sectional view of a second embodiment of the present invention wherein the invention is incorporated with an inlet receptacle of a waste receiving reservoir.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawing, FIG. 1 generally illustrates a parked recreational vehicle (hereinafter RV) 10 utilizing a coupling 12 embodying the principles of the present invention to facilitate the transfer of waste from the RV 10. Typically, RV waste is stored in a holding tank, a portion of which is shown at 14 in FIG. 1. The waste is transferred from the tank 14 to a waste reservoir 16 at a waste dump station. To connect the tank 14 to the waste reservoir 16, a waste hose 18 is extended therebetween. One end of the hose 18 is connected to a discharge fitting 20 on the tank 14, while the opposing end of the hose 18 is attached to the coupling 12, which is in turn inserted into a inlet receptacle 22 of the waste reservoir 16.

When not in use, the hose 18 and coupling 12 may be stored where convenient in the RV 10. Since space is generally at a premium, one possible place for storage is the rear bumper 24 of the RV 10. To facilitate storage, the rear bumper 24 is hollow and accepts the hose 18 and coupling 12 through an open end 26. Once the hose 18 and coupling 12 have been positioned within the bumper 24, the compartment of the bumper 24 may be sealed or closed by mounting on end cap (not shown) to the open end 26.

A preferred embodiment of the present invention is readily seen in FIG. 3. The coupling **12** includes a conduit **28** which is used to transfer the waste from the hose **18** to the inlet receptacle **22**. The outboard end of the hose **18** is attached to an inlet end of the conduit **28** by a clamp **30** or other securing means. This end of the conduit **28** is hereinafter referred to as the hose end **32**. The outlet end of the conduit **28** (hereinafter discharge end **34**) is inserted into the waste receptacle **22**.

The conduit **28** could have various configurations and shapes. In the preferred embodiment, the conduit **28** is generally L-shaped and includes an elbow bend **36** between the hose end **32** and the discharge end **34**, generally adjacent to the discharge end **34**. The elbow **36** is beneficial in that it helps to remove sag from the hose **18**, which can be disruptive of waste flow, by positioning the end of the hose **18** at the lowest possible position, substantially even with the ground. The elbow **36** also assists in maintaining the discharge end **34** of the coupling in the waste receptacle **22** and thereby prevents the discharge of waste onto the exterior of the waste reservoir **16**.

The conduit **28** can be formed of various materials, including metals and plastics. Preferably, conduit is formed of polyvinyl chloride (PVC) because of its durability, light weight, and imperviousness to the chemicals associated with waste treatment.

As previously mentioned, inlet receptacles **22** often vary in size from one waste reservoir to another. Previously, it was necessary for the RV owner to carry several adapters. This is undesirable for several obvious reasons. The first reason is again the space constraints of the RV **10**. Second, the adapters, in that there are a number of them, are easily misplaced or lost. Finally, the adapters must be manually attached and detached, often resulting in physical contact with the waste.

The present invention eliminates the drawbacks of adapters by entirely eliminating the need for adapters. In place of the adapters, the coupler **12** is provided with a sealing device **37** which may be temporarily inflated. Being inflatable, the sealing device **37** can accommodate all of the varying sizes of inlet receptacles **22** which might be encountered.

In operation, the discharge end **34** of the coupling **12** is inserted into the inlet receptacle **22** and the sealing device **37** is inflated. The inflated sealing device **37** is generally toroidal in shape and obstructs the opening of the waste receptacle **22** around the conduit **28**, thereby inhibiting the withdrawal of the conduit **28**, the discharge of waste onto the exterior of the waste reservoir **16**, and the emission of odors from the waste reservoir **16**.

The sealing device **37** will now be described in greater detail Attached to the discharge end **34** of the conduit **28** is an inflatable bladder **38**. Preferably, the bladder **38** extends circumferentially around the discharge end **34** and is secured thereto by adhesive **40** or other attaching method. The bladder **38** is made of resilient rubber, or other durable material, which will allow it to inflate and conform to the opening of the inlet receptacle **22**. When deflated, as seen in FIG. **4**, the discharge end **34** and the bladder **38** together exhibit a diameter which allows for both to be inserted into the opening of the inlet receptacle **22**. After being inserted into the inlet receptacle **22**, the bladder **38** is inflated to the position generally illustrated by the phantom lines, designated at **42**, and seals the opening of the inlet receptacle **22** around the discharge end **34** of the conduit **28**.

To inflate the bladder **38**, the coupling **12** is provided with a pneumatic hand pump **44**. During its actuation, the pump **44** intakes air through an intake port **46** and expels air through an exhaust tube **48** into the bladder **38**. Pump **44** is of the type having a resilient body or bellows **45** which is biased into an expanded or inflated position under the influence of forces inherent in the body's material. As such, the body **45** of the pump **44** may be made of a resilient rubber. Other materials could also be used for the body **45** of the pump **44** so long as they contain the necessary characteristics of inflation and deflation allowing for the pump's **44** operation. While the preferred embodiment utilizes a pneumatic hand pump **44**, other types of pumps and other working fluids could also be used, including mechanical or electric pumps driving a liquid.

Also contained within the pump **44**, but not shown, is one or more valves. The valves readily permit the intake of air through the intake port **46**. However, during the compression of the body **45** of the pump **44**, the valves are biased to force air to be expelled through the exhaust tube **48** into the bladder **38**. In actual use, the pump **44** is worked through a number of actuation cycles until the bladder **38** has been inflated to the desired size and sufficiently obstructs the opening of the inlet receptacle **22**.

After the discharge of waste into the dump reservoir **16**, the bladder **38** is deflated. A release valve **50** is mounted in line with the exhaust tube **48** to assist in permitting deflation. The release valve **50** can be one of numerous types presently available. In the preferred embodiment the release valve **50** includes a biased plunger or button **52** which, when depressed, permits the interior of the bladder **38** to communicate with the surroundings through the exhaust tube **48**. thereby allowing the bladder **38** to deflate under the forces provided by the resiliency of the rubber and atmospheric pressure.

The pump **44** and its related structures are shown as being mounted directly to the conduit **28**. This mounting is preferred because it decreases the chances that the pump **44** and the associated structures will be lost, broken or severed from the bladder **38**. The pump **44**, intake port **46**, exhaust tube **48** and release valve **50** may be secured to the conduit **28** by adhesives, screws, or other securing methods. To facilitate mounting, the various structures may include mounting flanges **54**. For the sake of clarity, mounting flanges **54** are only illustrates in relation to the release valve **50**.

An alternative embodiment is illustrated in FIG. **5**. The alternative embodiment includes a significant number of features which are common to both embodiments. For this reason, corresponding features of the second embodiment are designated with a prime (').

The sealing device **37'** includes an inflatable bladder **38'** which is secured interiorly of the opening defined by the inlet receptacle **22'**. The bladder **38'** extends circumferentially around the interior of the inlet receptacle **22'** and is secured therein by a mounting bracket **60**. The mounting bracket **60** includes a cylindrical portion **62** which extends into the inlet receptacle **22'** and a flange **64** prevents the bracket from being dropped into the waste reservoir **16**. A fastener **66** is inserted through the flange **64** to securely attach the mounting bracket **60** to the inlet receptacle **22'**. The bladder **38'** is mounted to the interior of the cylindrical portion **62** by adhesive **40'**

or another well known securement method. So mounted, the bladder **38'** defines an opening into which the discharge end **34** of the conduit **28** may be inserted. To protect the bladder **38'** during the insertion of the conduit **28**, the mounting bracket **60** is provided with a downwardly and inwardly turned guide lip **68** which extends so as to cover the deflated bladder **38'** from above.

After the discharge end **34** of the conduit **28** has been inserted into the opening being defined by the guide lip **68** and the bladder **38'**, the bladder **38'** is inflated to contact and conform to the exterior surface of the conduit's discharge end **34**, thereby sealing the opening of the inlet receptacle **22'**. As in the previous embodiment, the bladder **38'** is made of resilient rubber or other durable material which will allow it to inflate and conform to the exterior surface of the discharge end **34** of the conduit **28**.

To inflate the bladder **38'**, the seal **37'** is also provided with a pump or inflation means **44'**. For ease of operation and construction, the inflation means is preferably one of the pneumatic hand pump variety. The pump **44'** is actuated and constructed analogously to pump **44** of the previous embodiment, like elements again designated with like numbers bearing a prime (') designation. As such, the pump **44'** includes a resilient body or bellows **45'** having valves (not shown) which readily permit the intake of air through an intake port (not shown). When the bellows **45'** is compressed, air is forced through the exhaust tube **48'** to inflate the bladder **38'**. The bladder **38'** is deflated through its own resiliency once a release valve **50'** has been actuated. To simplify construction and costs, the release valve **50'** is preferably of a type which may be actuated through a biased plunger **52'** or other common actuator mechanism.

In the embodiment of FIG. **5**, the pump **44'** is mounted to a post **70** extending upward from the inlet receptacle **22'**. By elevating the pump **44'**, its operation is more easily accomplished by one wishing to dispose of waste into the waste reservoir **16**. The elevated mounting likewise prevents the pump **44'** from becoming soiled with waste in the event of an inadvertent discharge of waste prior to the insertion or sealing of the coupling **28** in the inlet receptacle **22'**.

While the above description constitutes the preferred embodiments of the present invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope and fair meaning of the accompanying claims.

We claim:

1. A recreational vehicle waste disposal system for transferring waste into a waste reservoir through an inlet opening of the waste reservoir, said disposal system comprising:

a waste holding tank for receipt and storage of waste generated during use of the recreational vehicle, said waste holding tank including a discharge fitting;

a waste hose for transferring waste from said waste holding tank, said waste hose having first and second ends, said first end adapted to be connected to said discharge fitting of said waste holding tank;

a conduit having inlet and outlet ends, said inlet end being secured to said second end of said hose and forming a discharge conduit therewith, said outlet end having an exterior diameter of a size allowing said outlet end to be inserted into the inlet opening of the waste reservoir;

an inflatable bladder formed of resilient material and being exteriorly mounted to said conduit adjacent said outlet end, said bladder being concurrently insertable into the inlet opening with said outlet end;

inflating means mounted to said discharge conduit for inflating said bladder and enabling said bladder to engage the inlet opening in sealing contact substantially circumferentially around said conduit thereby inhibiting withdrawal of aid conduit from the inlet opening during the transfer of waste from said waste holding tank through said waste hose into the waste reservoir; and

deflating means mounted to said discharge conduit for deflating said bladder thereby permitting removal of said conduit from the inlet opening of the waste reservoir.

2. A recreational vehicle waste disposal system as set forth in claim **1** wherein said deflating means includes a release valve being manually operable for releasing air from within said bladder and thereby deflating said bladder.

3. A recreational vehicle waste disposal system as set forth in claim **1** wherein said conduit includes an L shaped bend between said inlet and outlet ends, said bend orienting said inlet end and said outlet end substantially ninety degrees apart, said bend assisting in maintaining said outlet end of said coupling in the inlet opening and removing sag from said hose during use.

4. A recreational vehicle waste disposal system as set forth in claim **1** wherein said inflating means is a manually operable bellows pump mounted to said discharge conduit.

5. A sealing device as set forth in claim **4** wherein said inflating means is a bellows pump mounted to said discharge conduit along one side wall thereof, said pump being coupled to said bladder by an exhaust tube extending along side of said house and said conduit.

6. A sealing device as set forth in claim **5** wherein said deflating means is a manually operated release valve mounted on said discharge conduit and in line with said exhaust tube.

7. A sealing device as set forth in claim **6** wherein said release valve is a plunger valve.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,247,974

DATED : September 28, 1993

INVENTOR(S) : Charles L. Sargent, John M. Antos and George Grech

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

In Column 3, line 55, after "detail", insert --.--.

In Column 6, line 22, Claim 1, delete "aid" and insert in place thereof --said--.

Signed and Sealed this

Twenty-eighth Day of June, 1994

Attest:

Bruce Lehman

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

US005636648A

United States Patent [19]

O'Brien et al.

[11] **Patent Number: 5,636,648**

[45] **Date of Patent: Jun. 10, 1997**

[54] **MOBILE ROTATOR JET SEWER CLEANER**

[76] Inventors: **J. T. O'Brien**, 1702 Delogier Dr., Glenview, Ill. 60025; **Daniel J. O'Brien**, 2304 22nd Ave., Sterling, Ill. 61081

[21] Appl. No.: **452,970**

[22] Filed: **May 30, 1995**

[51] **Int. Cl.**[6] **B08B 9/02**

[52] **U.S. Cl.** .... **134/107**; 134/167 C; 239/197; 254/134.3 FT; 254/323; 254/332

[58] **Field of Search** .... 134/167 C, 168 C, 134/105, 107; 15/104.33, 315; 254/323, 325, 326, 327, 329, 332, 134.3 R, 134.3 FT; 239/175, 195, 197

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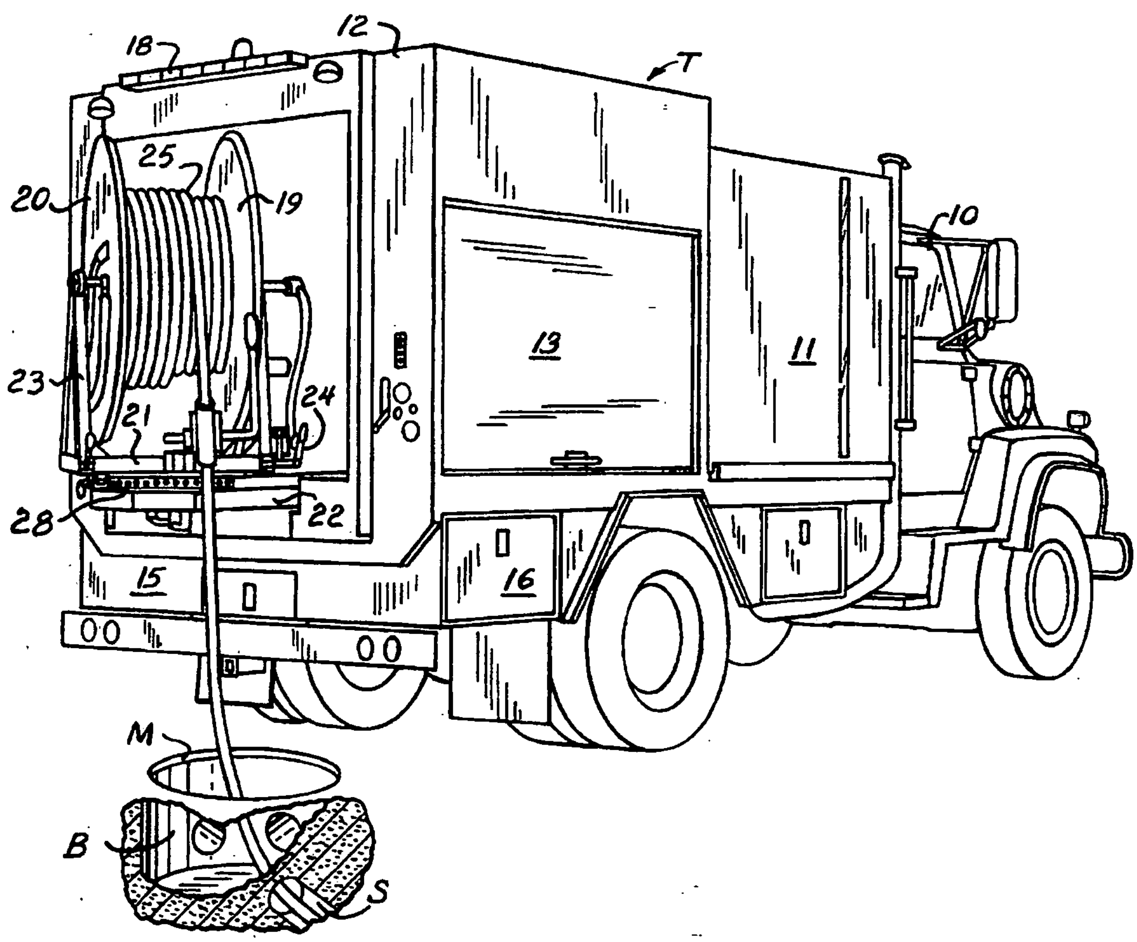
Primary Examiner—Philip R. Coe
Attorney, Agent, or Firm—Faier & Faier; Martin Faier

[57] **ABSTRACT**

A mobile rotator jet sewer cleaner vehicle for cleaning a sewer line by fluid pressure, the vehicle having a fluid supply for delivering the fluid under pressure to a hose wound on a reel assembly which can be selectively wound or unwound in a vertical direction, wherein a bearing assembly movable in a horizontal direction is secured on a platform and a reel assembly is mounted on and movable with the bearing assembly. A control for selectively actuating winding and unwinding the hose on the reel assembly is provided, and this control, which may also include other instruments and controls for operating the sewer cleaner, is movable with the bearing and reel assembly. In another embodiment of the invention, the platform telescopes into and away from a recess in the vehicle chassis, so that the reel and bearing assemblies are extended from the vehicle when in use, but may be retracted into the recess when desired, and in such event the retracted jet sewer cleaner may be enclosed within the vehicle.

19 Claims, 7 Drawing Sheets



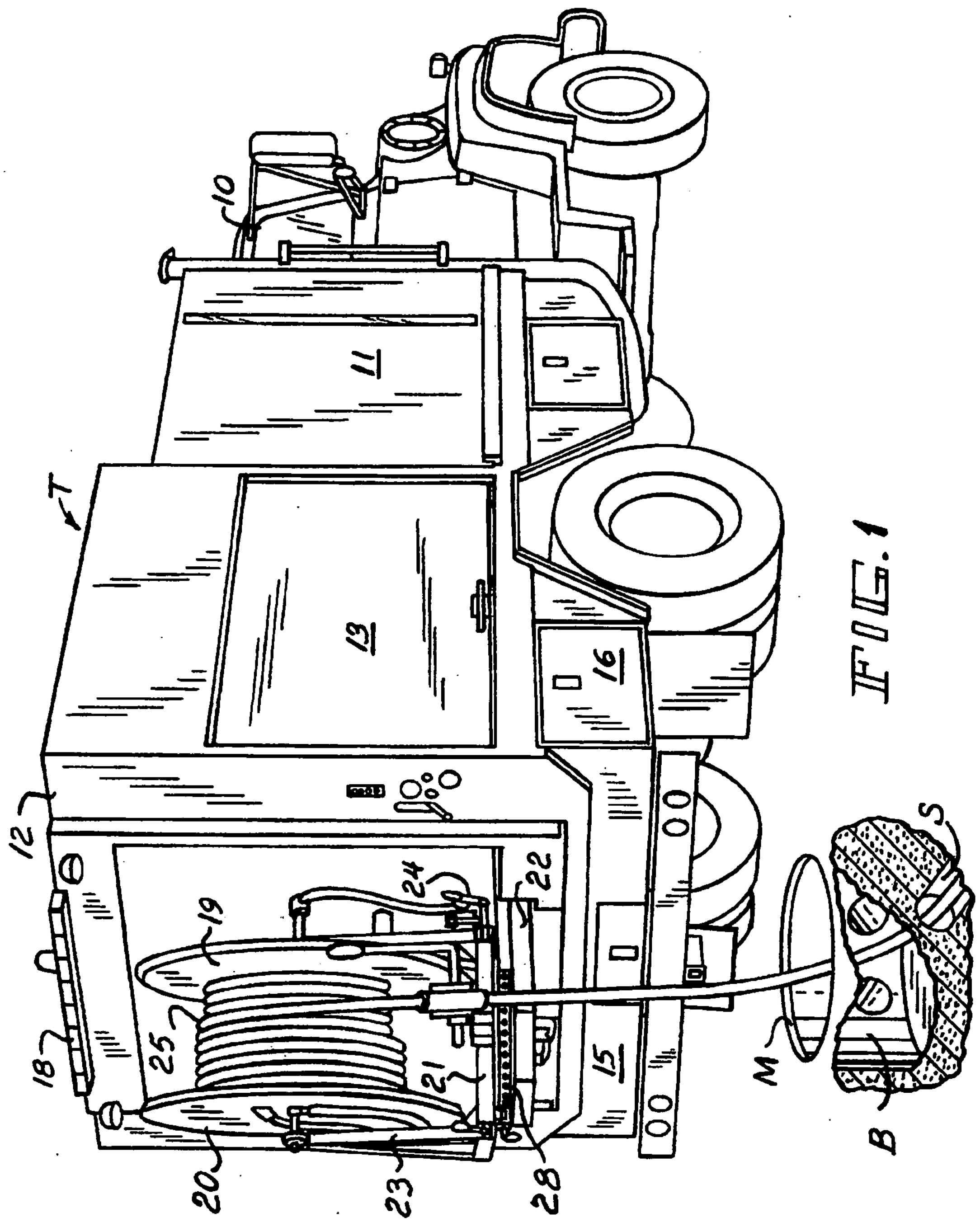


FIG. 1

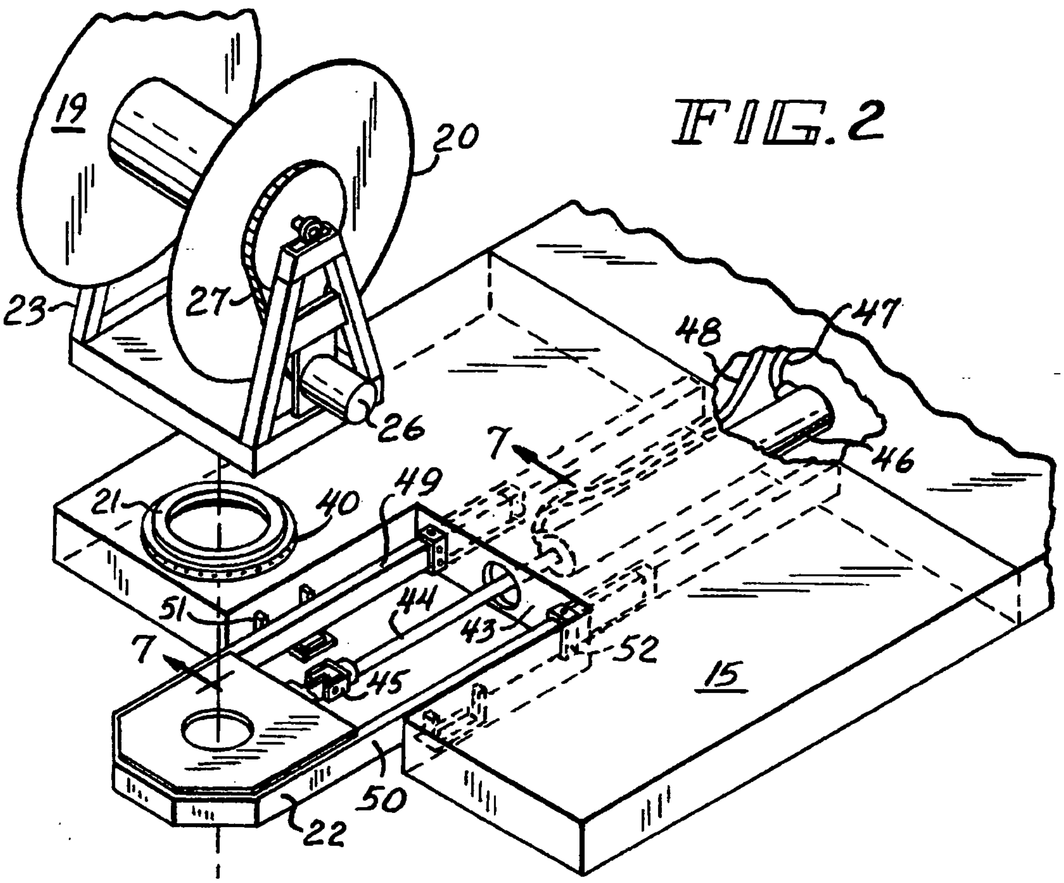


FIG.2

FIG.3

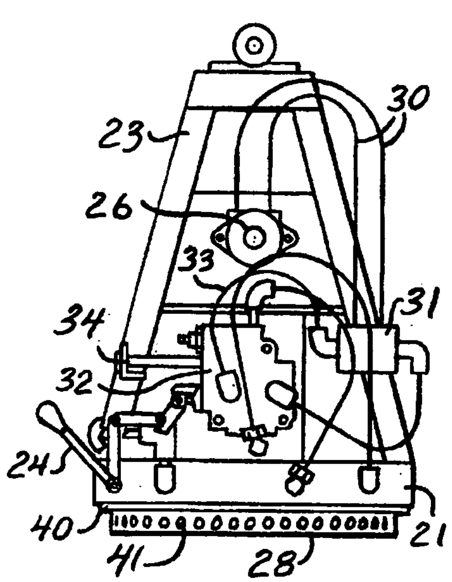


FIG.4

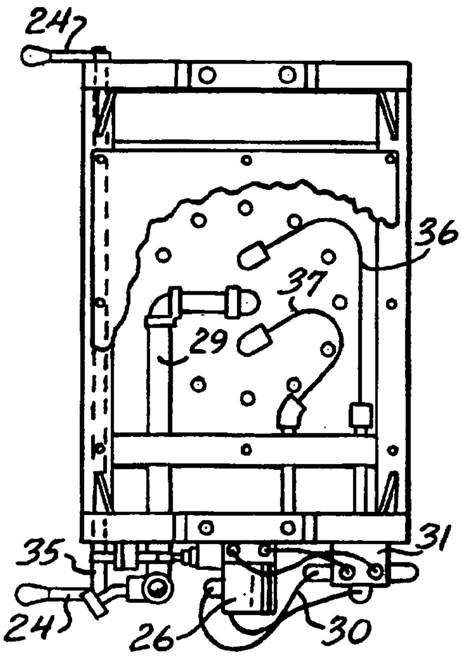
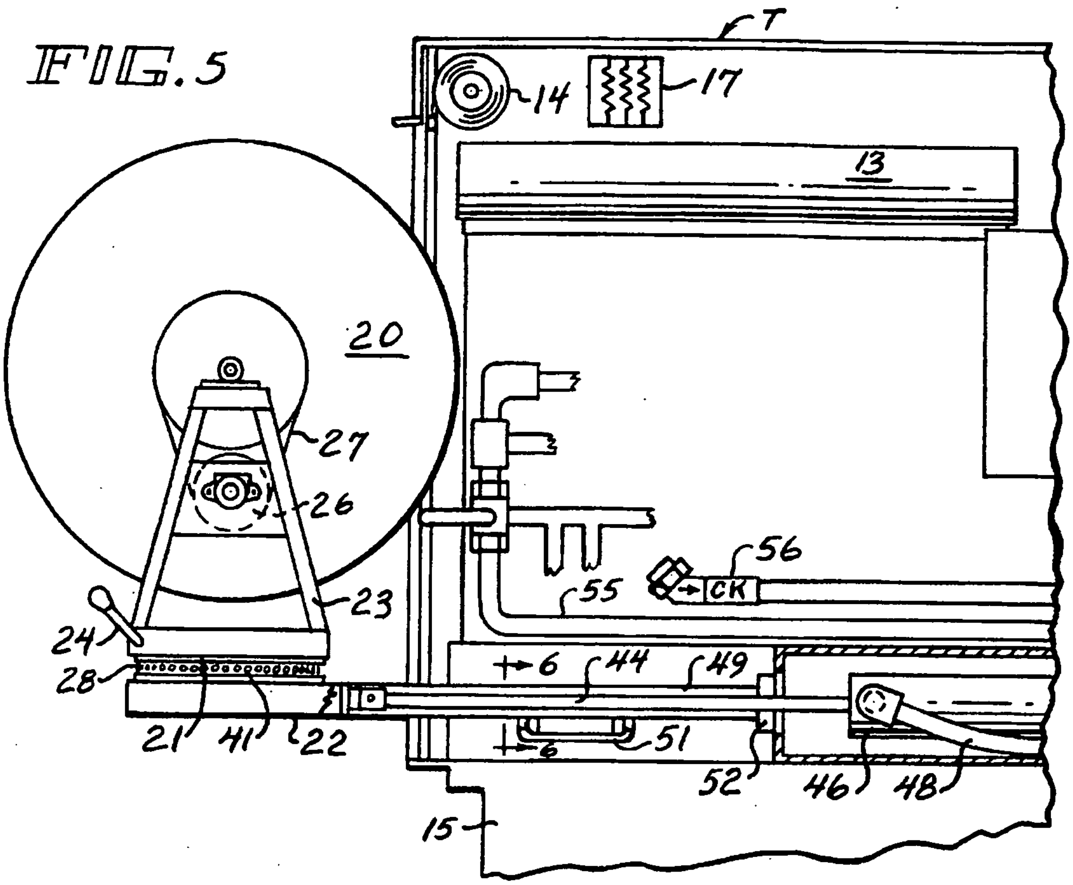


FIG. 5



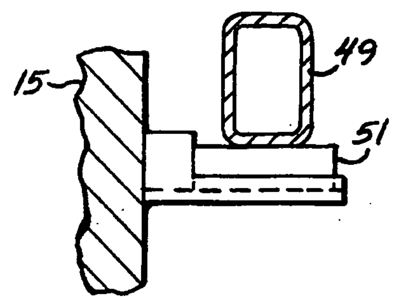
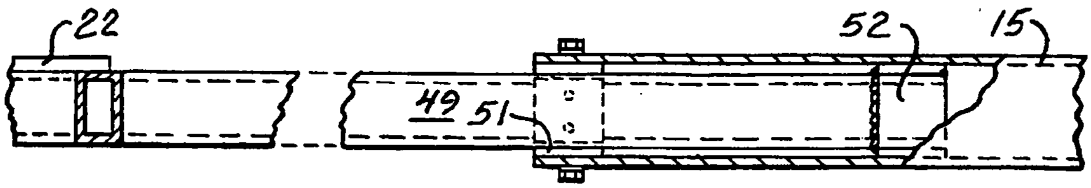


FIG. 6

FIG. 7



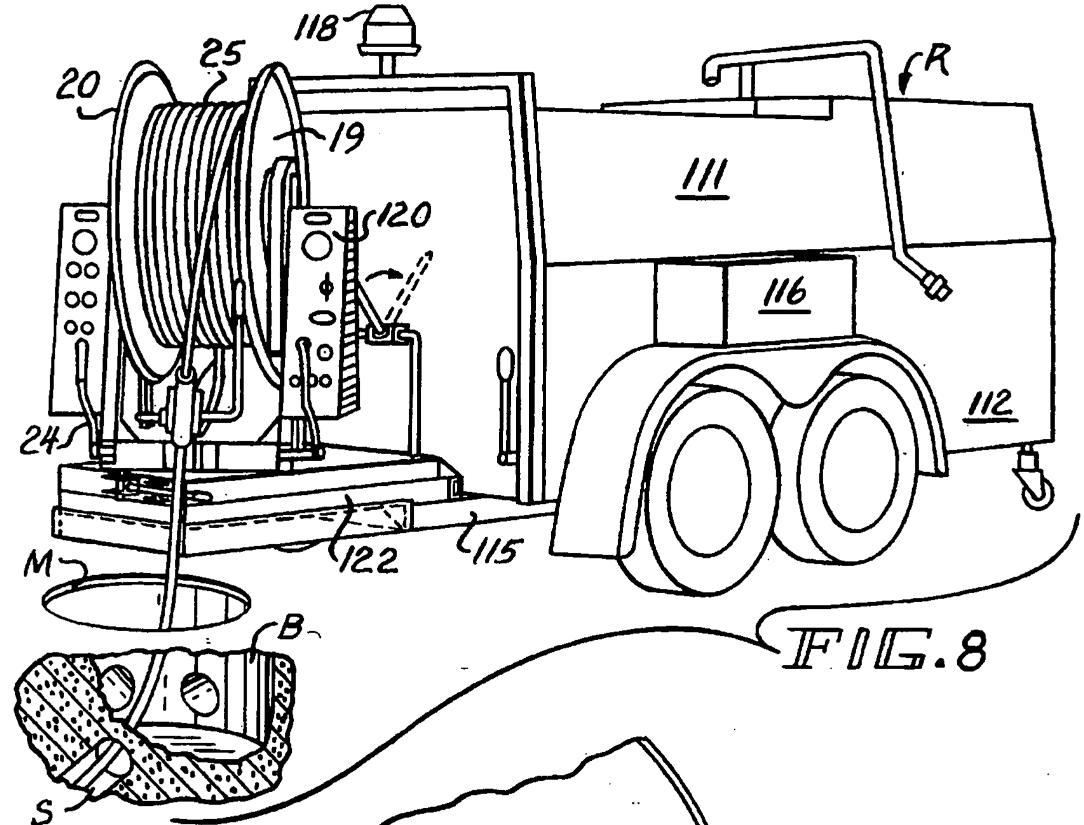

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FIG. 8

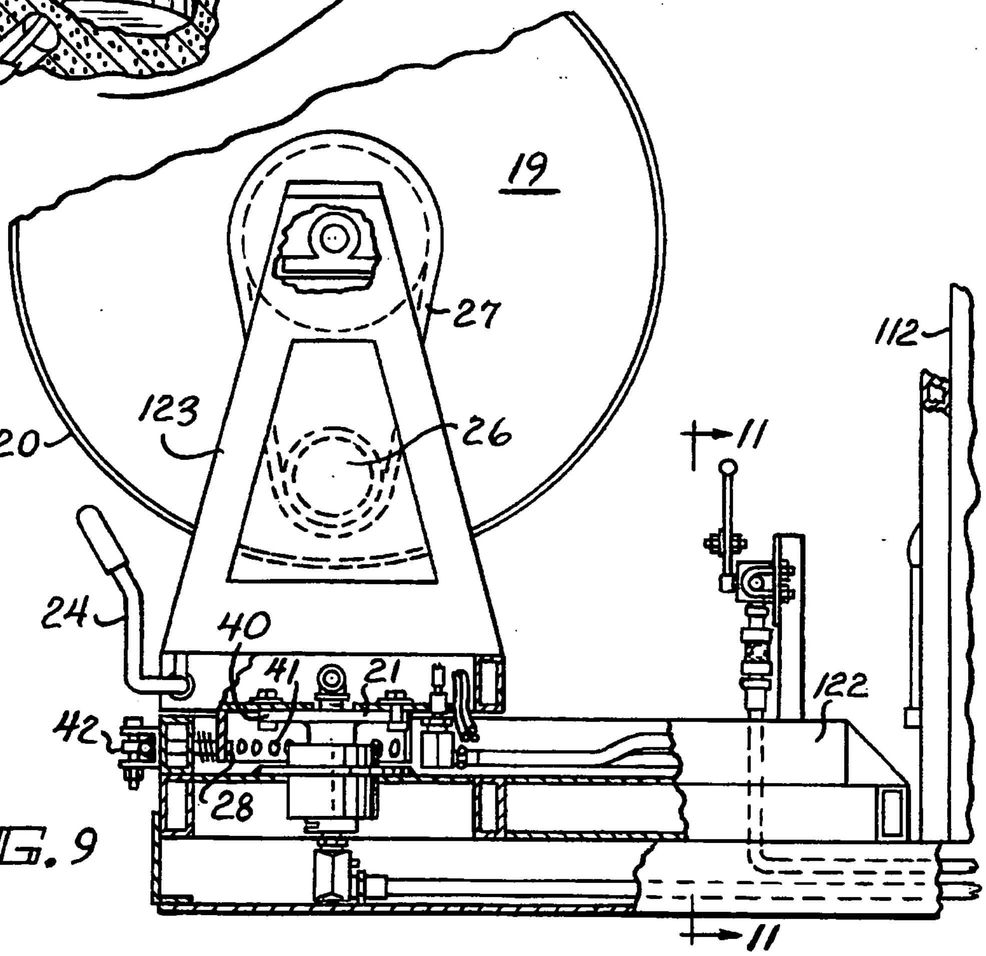
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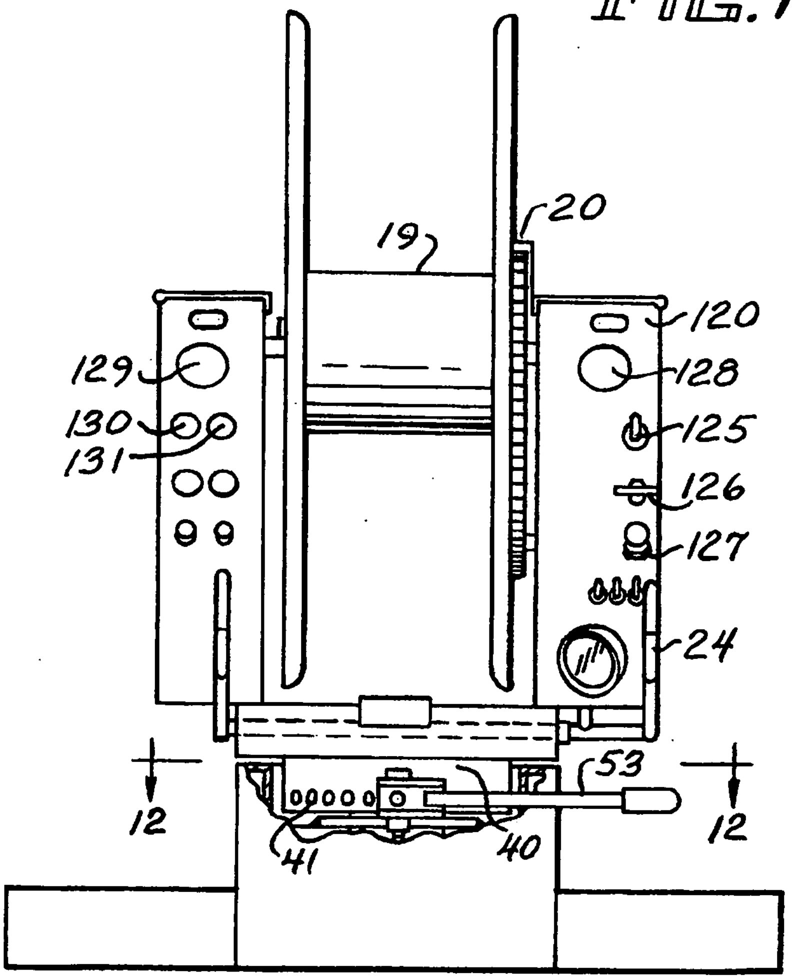
FIG. 9

FIG. 10



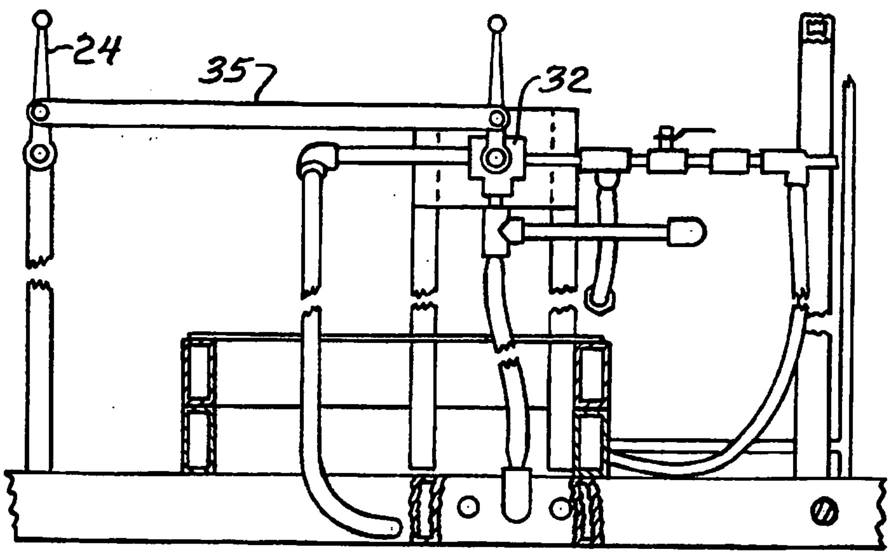


FIG. 11

FIG. 12

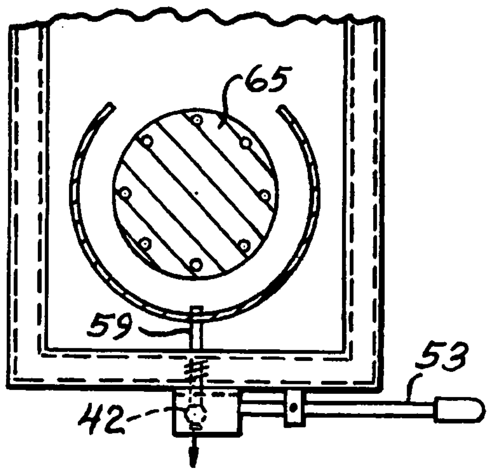


FIG. 13

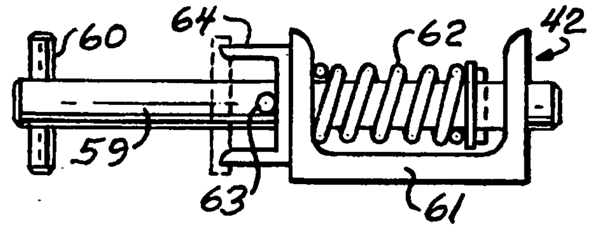


FIG. 14

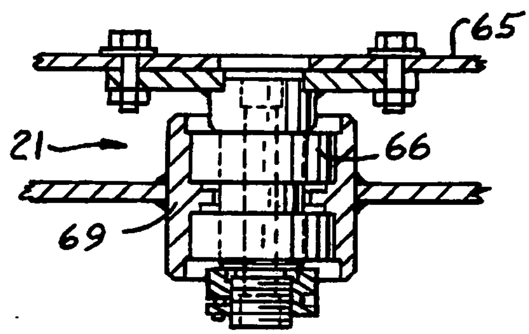


FIG. 15

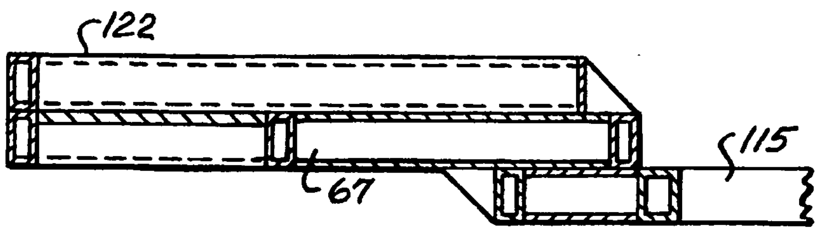
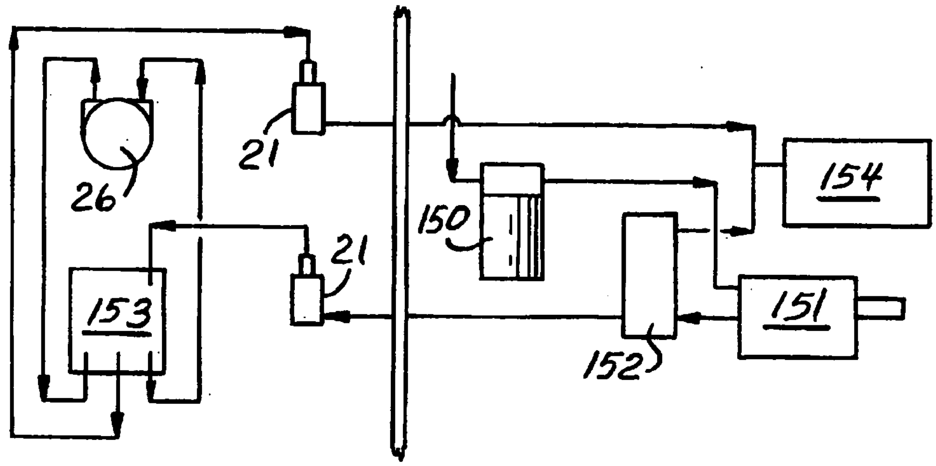


FIG. 16



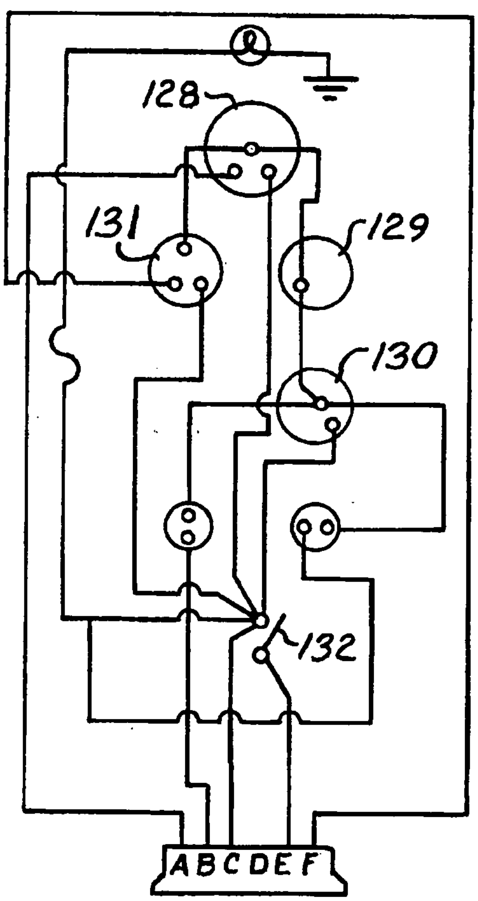


FIG. 17

MOBILE ROTATOR JET SEWER CLEANER

BACKGROUND OF THE INVENTION

This invention relates to mobile sewer cleaning vehicles, such as a truck or trailer, which include a hose for delivering a jet stream of fluid, such as water, under high pressure. More specifically, the invention relates to the construction of such vehicles which utilize high pressure hoses for cleaning sewers and sanitary basins. Such a hose is conventionally wound on a reel which is unwound to reach an area to be cleaned and rewound for transport and storage. A description of the background and prior art for the present invention is shown in U.S. Pat. No. 4,669,145.

SUMMARY OF THE INVENTION

The present invention deals specifically with the manner in which the hose on a reel is presented to the sewer line to be cleaned and the manner in which the reel is articulated for its most convenient and effective safe entry into and through the sewer line, and also deals with the placement and availability of controls for managing the position of the hose, winding and unwinding the hose on its reel, delivery of fluid under pressure and other control features.

These novel features offer safety and convenience not available in known conventional sewer cleaning equipment. By use of a device embodying the present invention, an operator may rotate the reel to deliver the jet hose into a manhole in a straight line from any location near the work zone, without having to park directly over the manhole, thus minimizing the need to work or back up in traffic. Wear and tear on hoses is also reduced, because the operator may avoid steep or excess angles or other obstacles which may injure or snag the hose. Avoiding the effects of hose strain, wear and breaks also result in fewer situations where the hose will break under pressure, injuring persons and equipment in its way.

By providing and securing the novel hose reel on a novel frame which is revolvable on a novel bearing assembly embodying the present invention, the benefits indicated in this application are achieved. Controls may likewise be secured on this novel frame—bearing assembly, so that an operator may manipulate the controls while delivering the hose from the reel into the sewer line.

In such preferred embodiments of the invention, the high pressure hose and its reel is mounted on the novel rotating revolving reel frame assembly movably secured on the novel bearing assembly to articulate the reel into a selected position permitting the delivery of the hose lined up with the sewer line. In a related preferred embodiment, the frame—bearing assembly is secured on a telescopic platform, permitting the assembly to move toward and away from the vehicle frame and when not in use the reel, which when in use is telescopically extended beyond the end of the vehicle, can be retracted to a position inside the vehicle end, permitting the reel frame—bearing assembly to be enclosed within the vehicle by means of a rolling door.

OBJECTS OF THE INVENTION

It is the object of the invention to provide a mobile rotator jet sewer cleaner vehicle of the character recited.

It is also a principal object of the present invention to provide a hose reel assembly for a sewer cleaner vehicle which is capable of rotation on a bearing to a point satisfactory to the operator in line with a sewer line.

Another object is to provide a hose and reel assembly which may be situated beyond the perimeter of the vehicle on which it is mounted and which may be selectively articulated relative to a sewer line.

Another object is to be provide a hose and reel assembly secured on a novel platform and bearing assembly which may be telescopically moved into a closed vehicle and out of the vehicle when utilized to clean a sewer.

Another object is to provide a hose and reel assembly mounted on a novel platform and bearing assembly which carries controls for cleaning a sewer, allowing one person to control delivery of fluid and rotation of the hose on the reel from a selected position, while viewing entry of the hose into a sewer line.

Another object is to provide a fluid jet sewer cleaner hose and reel assembly, which may be selectively wound and unwound, mounted on a novel platform and bearing assembly which may be articulated and locked in a selected position.

Another object of the invention is to provide a mobile rotator jet sewer cleaner vehicle which is simple, easy, efficient, safe and convenient to use under most task situations.

These and other objects and advantages will become apparent as this description proceeds, taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a perspective view of a preferred sewer cleaner vehicle embodying the present invention in operable position, which in this embodiment comprises a truck.

FIG. 2 is an isometric view of the telescoping platform for the truck shown in FIG. 1, showing the hose reel and bearing assembly on the platform.

FIG. 3 is a side view in schematic format showing the reel bearing and frame assembly (but omitting the reel), including the hydraulic system for controlling rotation of the hose reel.

FIG. 4 is a top view of the reel bearing and frame assembly, including the hydraulic system, of the embodiment shown in FIG. 3, with parts broken away.

FIG. 5 is a schematic cut away right side view of the truck and its telescoping platform fully extended with the reel and bearing assembly mounted thereon, with parts broken away.

FIG. 6 is a section detail view of part of the extension bar for the telescoping platform fully extended on which the reel and bearing assembly is mounted, taken on line 6—6 of FIG. 5.

FIG. 7 is a detailed section view taken along line 7—7 of FIG. 2, showing the telescoping beams for the platform which carries the rotatable reel and hose assembly.

FIG. 8 is a perspective view of another preferred sewer cleaner vehicle embodying the present invention in operable position, which in this embodiment comprises a trailer.

FIG. 9 is a sectional view of the hose reel and bearing assembly for the embodiment shown in FIG. 8.

FIG. 10 is a elevational view, with part of the bearing broken away, of the hose reel and bearing assembly shown in FIG. 9.

FIG. 11 is a view of the reel bearing assembly taken on line 11—11 of FIG. 9.

FIG. 12 is a section view of the bearing assembly taken on line 12—12 of FIG. 10.

FIG. 13 is an enlarged elevational detail view of the reel rotation lock subassembly for positioning the reel and bearing assembly shown in FIG. 9.

FIG. 14 is a sectional view of the bearing hub for the bearing assembly shown in FIG. 9.

FIG. 15 is detail sectional view of the platform for the hose reel and bearing assembly for the trailer embodiment shown in FIG. 8.

FIG. 16 is a schematic view of part of a typical hydraulic system for a trailer embodiment shown in FIG. 10.

FIG. 17 is a schematic view of a panel for the control system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1–7, the mobile sewer cleaner vehicle embodying the invention comprises a truck T, and in FIGS. 8–17, the vehicle embodying the invention comprises a trailer R. Novel features shown in the truck environment can be utilized on a trailer and novel features shown in the trailer environment can be utilized on a truck, without departing from the scope or spirit of the invention. Either vehicle may be used for cleaning a sewer line by means of a rotator jet arranged on a hose windable on a reel which rotates on a bearing assembly.

As shown in the truck embodiment depicted in FIGS. 1–7, the truck, which has a driver's cab 10, a hold 11 for storing water or other fluid, and a frame 12 which is closed by one or more side doors 13 and a rear door 14, which may be of roll-up style, and is mounted on a truck chassis 15. There may be a container 16 for storing tools secured to the chassis 15, and a heater device 17 may be mounted within the closeable part of the frame 12; hazard lights 18 may be mounted on the frame for warning the public when the truck is servicing a sewer.

The truck embodying the present invention has a hose reel 19 arranged in a reel assembly 20 windable in a vertical direction which is secured for horizontal rotation on a bearing assembly 21 which is mounted on a telescoping platform 22, and the hose reel assembly is arranged in a frame 23, which may be extended beyond the end of the truck T, so that its hose 25 can be wound or unwound on the reel 19 and fed into a sewer tunnel or line S extending from a bell B in a manhole M in straight line relationship between the hose and the sewer tunnel. Winding and unwinding of the hose 25 in a vertical direction on the reel assembly 20 may be accomplished by use of a motor 26, preferably hydraulic. The reel assembly 20 may also be articulated in a horizontal direction on the bearing assembly 21, which has a plurality of ratchet members 28 for locking the reel assembly in a selected position, preferably in line with the manhole M and sewer line S.

With reference to FIGS. 2 and 3, mounted on the reel frame 23 is the hydraulic motor 26 which drives a chain 27 for turning the reel 19 in the reel assembly 20 in a selected direction to wind or unwind hose 25 arranged on the reel. This motor 26 can be selectively run in either forward or reverse direction, depending upon the direction of movement of the hydraulic fluid, and is fed by hydraulic lines 30 which are connected to a brake valve 31 which is actuated by fluid passing through control valve 32 having fluid intake and outlet hoses 33 connected to the valve 31. The speed of winding or unwinding of the reel 19 is controlled by hydraulic speed adjustment device 34, and the direction of hydraulic fluid movement is controlled by adjuster mechanism 35 linked on opposed sides to the control valve 32.

As shown in FIG. 4, the reel frame 23 also carries hydraulic fluid lines 36 and 37. High pressure intake line 29 is controlled by the adjuster mechanism 35 for which its control handles 24 linked on both the right and left side of the frame 23 can be seen, so that an operator can control winding or unwinding of the hose 25 on the reel assembly 20 from either side of the reel 19.

The reel frame 23 is secured on the bearing assembly 21 which is horizontally rotatably secured to the platform 22, which is carried by the chassis 15 of the vehicle. This bearing assembly 21 preferably has a ring 40 about which are spaced a series of apertures 41 and a reel rotation lock subassembly 42 of the kind shown in FIG. 13 may be used to lock the reel in a selected position, preferably with the hose 25 arranged in line with the sewer line S to be cleaned.

As best shown in FIG. 2 and 5, this reel assembly 20 and bearing assembly 21 may be mounted on a telescoping platform 22, which is intended to move the reel assembly 20 and bearing assembly 21 into a recess 43 formed in the chassis 15 permitting the reel and bearing assemblies to be retracted into the confines of the vehicle frame 12 for storage and transportation and to be extended from the vehicle chassis 15 when in use. When the platform 22 is retracted, the vehicle frame 12 may be closed by the doors 13 and 14 and the on-board heater 17 may be used to melt any ice which has formed in the hose 25, eliminating the danger of ice being forced from the hose under pressure when placed into use in colder climates.

This platform 22 is connected to a central ram 44 by means of a yoke 45 at one end of the ram and the other end of the ram is secured in a hydraulic piston cylinder assembly 46, for which fluid is provided by means of an inlet pipe 47 and outlet pipe 48 connected to a hydraulic motor or take-off (not shown) which drives the ram 44 toward and away from the end of the chassis 15, to extend or retract the platform. This platform 22 also has a pair of opposed beams 49 and 50 each of which at one end rides over support member 51 formed in the chassis 15 and at the other end in the rear of the recess 43 are supported by tubular supports 52 secured in the chassis.

Details of this structure for supporting the platform 22 by means of the beams 49–50 and support members 51, together with the tubular supports 52 secured in the chassis 15 is schematically shown in FIG. 2, with details shown in FIG. 5 and 6. FIG. 7, taken on line 7—7 of FIG. 2, also shows details of the platform 22 supported by the beans 49 over supports 51 through tubular supports 52 nested in the recess 43 of the chassis 15.

Fluid, such as water under pressure, is delivered to the hose reel assembly 20 by means of conventional piping connecting the fluid hold 11 and the hose 25, which may also including conventional check valve 56 and similar conventional fluid delivery and pumping mechanism (not shown).

With reference to the trailer type mobile rotator jet sewer cleaner shown in FIGS. 8–17, the trailer R has a water hold 111 contained within a closed truck frame 112 and the frame may carry a tool container 116. A hazard light 118 may be mounted on the trailer, too. As shown in FIG. 8, this embodiment also can be manipulated so that the reel assembly 20 and hose 25 are in line with the sewer line S to be cleaned, entering a manhole M through a bell B in a manner similar to that described with reference to FIGS. 1–7.

In this embodiment of the invention, a hose reel assembly 20 is carried by a articulatable bearing assembly 21, but, as compared with the truck embodiment, the platform 122 may be fixed and secured to the trailer chassis 115. The reel frame

123 shown in this embodiment has one or more extensive control panels 124, to be described hereafter.

A hose 25 is mounted on the reel assembly 20 for winding and unwinding and driven by a motor 26, preferably hydraulic, so that it may operate in selectively reversible directions. Preferably, the bearing assembly 21 has bearing ratchets members 28 spaced about its periphery. Preferably, the reel 19 of the reel assembly 20 is rotated in a vertical direction by means of a chain 27 connecting the motor 26 and the reel 19. The motor 26 is actuated by hydraulic fluid delivered through lines, valve and mechanism in the same manner as described with reference to the truck embodiment shown in FIGS. 1–7.

Preferably, bearing assembly 21 comprises a bearing ring 40 which has peripheral apertures 41, and, as shown in FIGS. 12–13, a lock subassembly 42 is adapted to engage within a selected aperture 41, thus lining up the hose reel 20 with manhole M. This lock subassembly 42 comprises a shaft 59, with a cross-pin 60 on one end and a bracket 61 on its other end which is biased by a spring 62 to enter into a selected aperture 41, but which may be withdrawn from the aperture and twisted so that a cooperating second cross-pin 63 may be engaged against a flange 64 to hold the lock subassembly out of an aperture, thus permitting the plate 65 of the bearing assembly 21 to freely turn on its bearing block or hub 66, in the bearing housing 69, shown in FIG. 14. Preferably, the lock subassembly 42 is operated by means of a lock handle 53.

The fixed platform 122 which carries the hose reel assembly 20, bearing assembly 21 and related parts, may comprise a plurality of beams 67 welded together to extend from the trailer chassis 115, as shown in FIG. 15.

In the embodiment shown in FIGS. 8–9 and 17, a plurality of instruments and controls are mounted on control panel 120 movable with the reel frame 123, rather than just the controls for the reel 20 as shown in FIG. 1. Here, the reel frame 123 carries not only the handles 68 for the control valve 132, but also such controls and instruments as an ignition switch 125, choke 126, throttle 127, tachometer 128, oil pressure gauge 129, voltmeter 130, water temperature gauge 131, circuit breaker 132, and possibly other devices; and all of these instruments and controls are available to a single operator while the entry and manipulation of the hose into a sewer line is adjusted and controlled.

With reference to the hydraulic system for driving the reel assembly 20 illustrated schematically in FIG. 16, showing a plurality of hydraulic lines connecting various devices, hydraulic fluid enters through a filter 150 where its is circulated by a hydraulic pump 151 through a pressure relief valve 152 into the bearing assembly 21 or rotary swivel mechanism (having opposed ports), which may function to deliver fluid in a selected one of opposed directions, where energy is delivered to a cross valve 153 operating as the reel control valve 32 to actuate the reel drive motor 26, and then fluid is delivered to a tank 154 for reentry into the system. Other piping and valve arrangements may also be provided to accomplish the movement of parts and components forming the invention as described.

While preferred embodiments of the invention have been shown and described in considerable detail, it should be understood that many changes may be made without departing from the scope or spirit of the invention, and it is not desired that the invention should be limited to the exact constructions shown and described.

We claim:

1. In a mobile rotator jet sewer cleaner vehicle for cleaning a sewer line, said vehicle having a fluid supply for delivering fluid under pressure to a hose wound on a reel assembly and adapted to be selectively wound or unwound in a vertical direction, the improvement comprising:
   (a) a chassis for said vehicle;
   (b) a platform secured on said chassis and selectively movable horizontally toward and away from said vehicle;
   (b) means for selectively moving said platform into a first position within the confines of said vehicle and a second position extending from said vehicle,
   (c) a bearing assembly movable on and secured to said platform adapted for articulation in alignment with said sewer line;
   (d) said reel assembly being mounted on and movable with said bearing assembly;
   (e) fluid transfer means for delivery of pressurized fluid into said hose from said vehicle fluid supply; and
   (d) control means for selectively actuating winding and unwinding of said hose on said reel assembly.

2. In the sewer cleaner vehicle recited in claim 1, wherein said reel assembly comprises a frame, a motor and drive means mounted on said frame, and a reel for said hose movably secured for rotation in a vertical direction to said frame and connected to said motor and drive means.

3. In the sewer cleaner vehicle recited in claim 2, wherein hydraulic connections secured to said frame deliver fluid to said motor.

4. In the sewer cleaner vehicle recited in claim 3, wherein said hydraulic connections enter said reel assembly through said bearing assembly.

5. In the sewer cleaner vehicle recited in claim 4, wherein said hydraulic connections are secured to said platform when entering said bearing assembly.

6. In the sewer cleaner vehicle recited in claim 1, wherein said bearing assembly comprises a ring movable with said reel assembly revolvable on said platform in a horizontal direction and stop means for securing said ring in a selected position.

7. In the sewer cleaner vehicle recited in claim 7, wherein said ring has a plurality of apertures spaced about its periphery.

8. In the mobile rotator jet sewer cleaner vehicle recited in claim 1, wherein a control and instrument panel is secured to said reel assembly, said control and instrument panel being horizontally pivotable and movable with said platform.

9. In the mobile rotator jet sewer cleaner vehicle recited in claim 8, wherein said control and instrument panel comprises switches and devices for actuating and indicating the performance of said sewer cleaner.

10. In a mobile rotator jet sewer cleaner vehicle for cleaning a sewer line, said vehicle having a fluid supply for delivering fluid under pressure to a hose wound on a reel assembly and adapted to be selectively wound or unwound in a vertical direction, the improvement comprising:
   (a) a chassis for said vehicle;
   (b) a platform secured on said chassis and selectively movable horizontally toward and away from said vehicle,
   said chassis having a recess for said platform;
   (b) a piston-cylinder assembly for selectively moving said platform into a first position within the confines of said vehicle and a second position extending from said vehicle;
   (c) a bearing assembly movable on and secured to said platform adapted for articulation in alignment with said sewer line:

(d) said reel assembly being mounted on and movable with said bearing assembly; and

(d) control means for selectively actuating winding and unwinding said hose on said reel assembly.

11. In the sewer cleaner vehicle recited in claim 10, wherein said windable reel assembly is driven by a hydraulically actuated motor.

12. In the sewer cleaner vehicle recited in claim 11, wherein said hydraulically actuated motor is selectively reversible for driving said reel assembly in opposed directions to selectively wind or unwind said hose responsive to said control means.

13. In the sewer cleaner vehicle recited in claim 11, wherein a speed adjustment device controls the speed at which said hose is wound or unwound on said reel assembly.

14. In the sewer cleaner vehicle recited in claim 13, wherein said speed adjustment device is secured to and movable with said reel assembly.

15. In the mobile rotator jet sewer cleaner vehicle recited in claim 10, wherein said platform has spaced apart beams extending into said recess.

16. In the mobile rotator jet sewer cleaner vehicle recited in claim 15, wherein said chassis has support means for carrying and guiding said platform beams into and away from said recess.

17. In the mobile rotator jet sewer cleaner vehicle recited in claim 10, wherein said vehicle has a closed frame into which said platform may be recessed.

18. In a mobile rotator jet sewer cleaner vehicle for cleaning a sewer line, said vehicle having a fluid supply for delivering fluid under pressure to a hose wound on a reel assembly adapted to be selectively wound or unwound in a vertical direction, the improvement comprising:

(a) said vehicle being normally closed but having a selectively openable door adapted to be opened for sewer cleaning use;

(b) a platform secured in said vehicle selectively movable horizontally to extend outwardly from said vehicle through said door when opened and to retract into said vehicle for permitting said door to be closed;

(c) means for moving said platform into said selectively movable positions,

(d) a horizontally movable bearing assembly secured on said platform adapted for articulation in alignment with said sewer line;

(e) said reel assembly being mounted on and movable with said bearing assembly;

(f) fluid transfer means for delivery of pressurized fluid into said hose from said vehicle fluid supply; and

(g) control means for selectively actuating winding and unwinding of said hose on said reel assembly.

19. In the mobile rotator jet sewer cleaner vehicle recited in claim 18, wherein said vehicle when closed has heater means.

* * * * *

US005653262A

United States Patent [19]

Hanemaayer

[11] **Patent Number: 5,653,262**

[45] **Date of Patent: Aug. 5, 1997**

[54] **SEWER DISCHARGE AND STOWING SYSTEM FOR A RECREATION VEHICLE**

[76] Inventor: **Jacobus N. Hanemaayer**, 100 Shirley Avenue, Kitchener, Ontario, Canada, N2B 2E1

[21] Appl. No.: **616,573**

[22] Filed: **Mar. 15, 1996**

[51] Int. Cl.^{6} **F16K 27/12**

[52] U.S. Cl. **137/899**; 137/355.16

[58] Field of Search 137/899, 355.16

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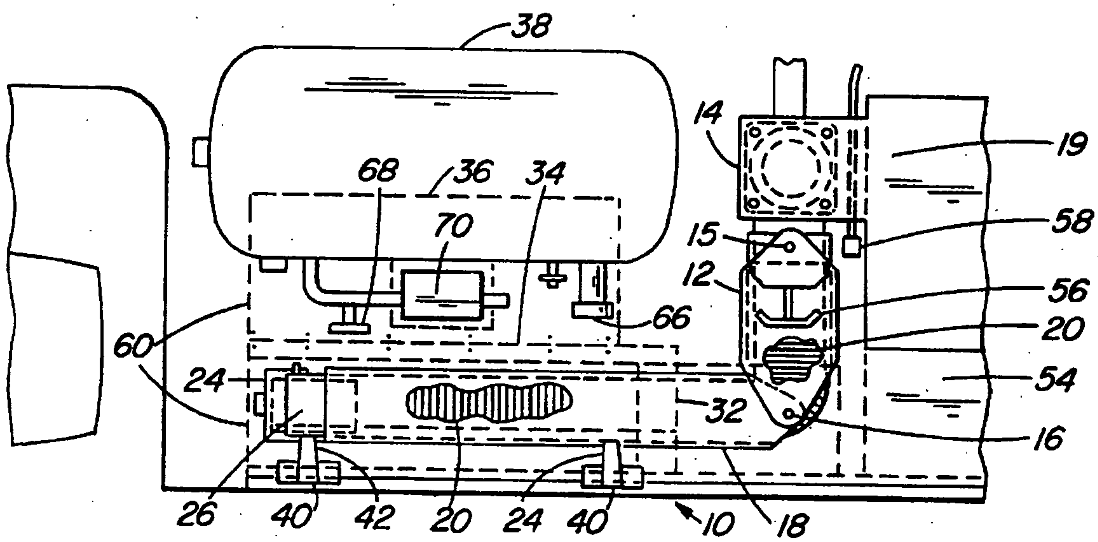
Primary Examiner—A. Michael Chambers

Attorney, Agent, or Firm—Killworth Gottman Hagan & Schaeff LLP

[57] **ABSTRACT**

A recreational vehicle or the like including a vehicle body having opposed sides and a waste storage tank with an axially extendable flexible hose connected to a waste outlet of said tank, said waste outlet being at a lower portion of the body adjacent one of the sides thereof. An elongated tubular housing is provided within which said flexible hose extends such that the hose can be stored in said housing and also drawn outwardly of a distal end of the housing toward a waste receptacle. The housing has an articulated connection at a proximal end thereof adjacent said waste outlet to enable said housing to be articulated relative to the body of the vehicle from a storage position wherein said housing extends generally parallel to said one of said body sides to a use position wherein said housing extends outwardly from said one side of the vehicle body.

15 Claims, 7 Drawing Sheets



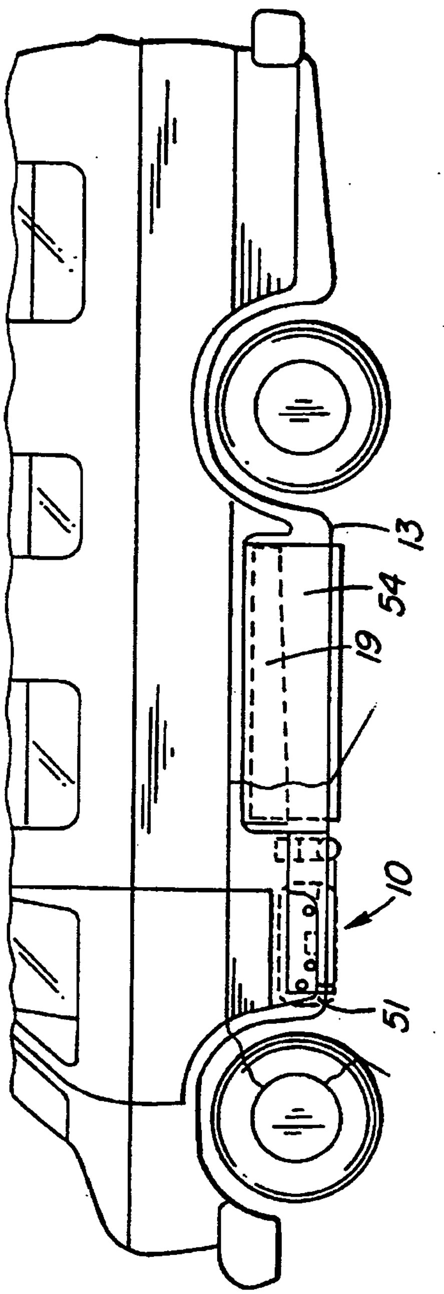

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FIG. 1

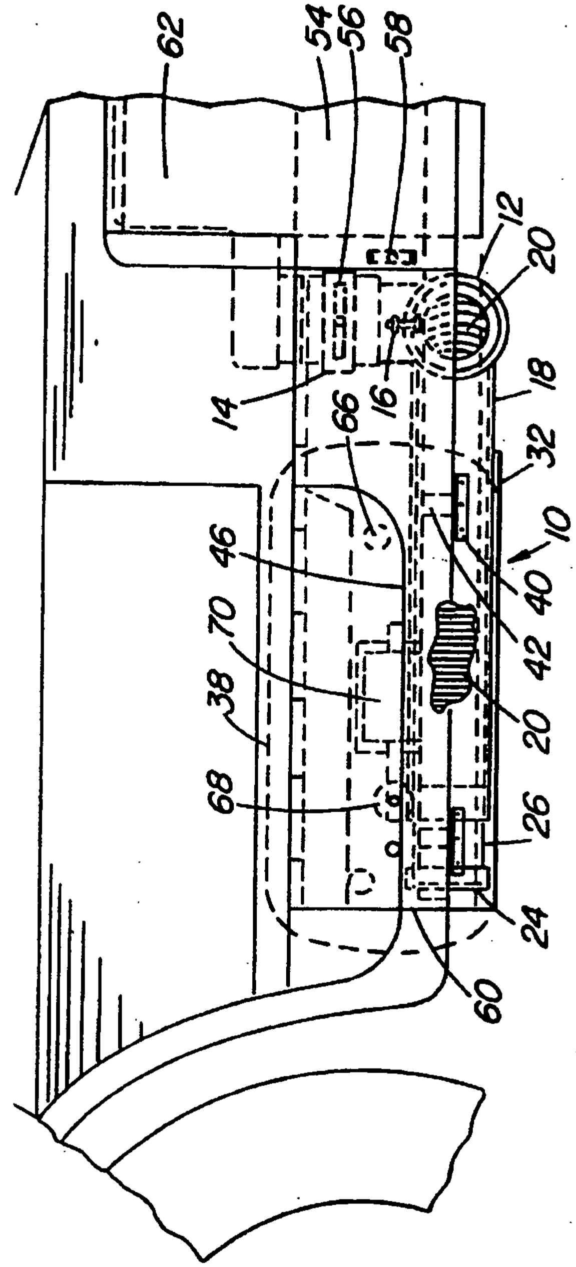
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FIG. 1A

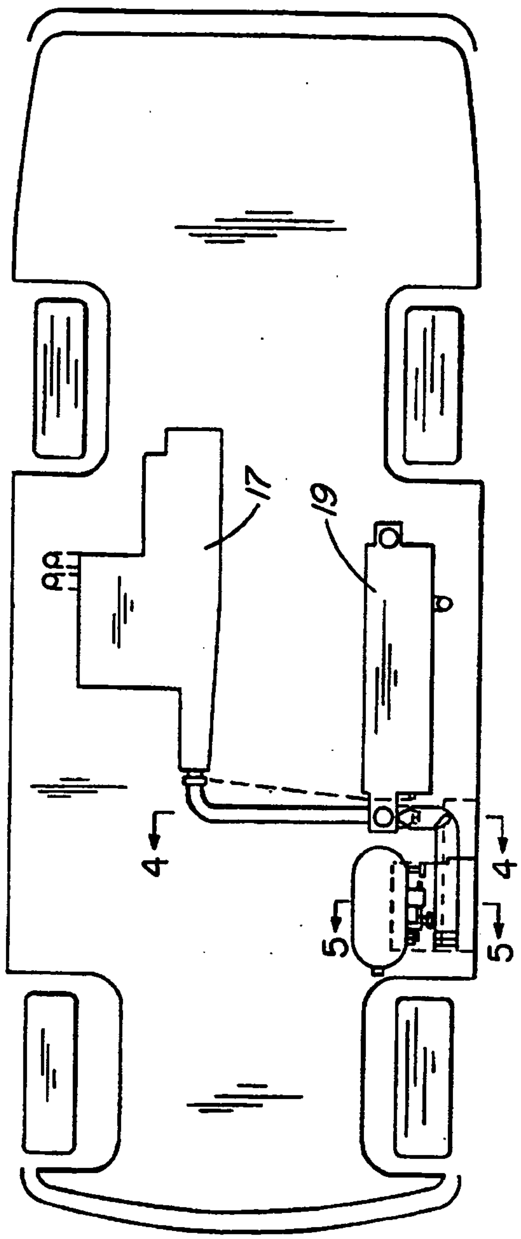
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FIG. 2

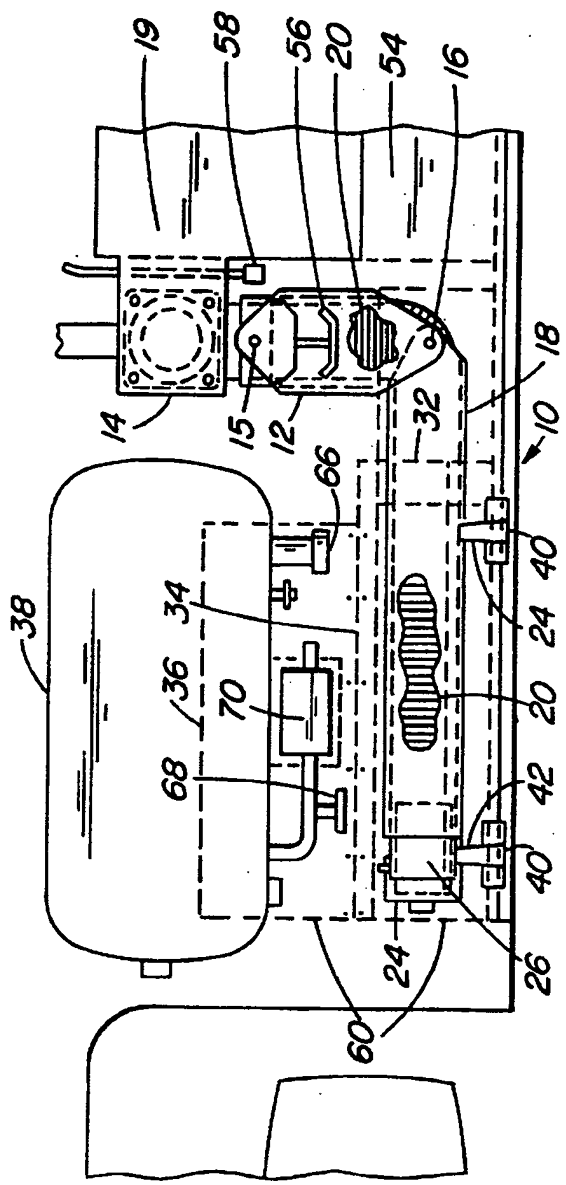
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FIG. 2A

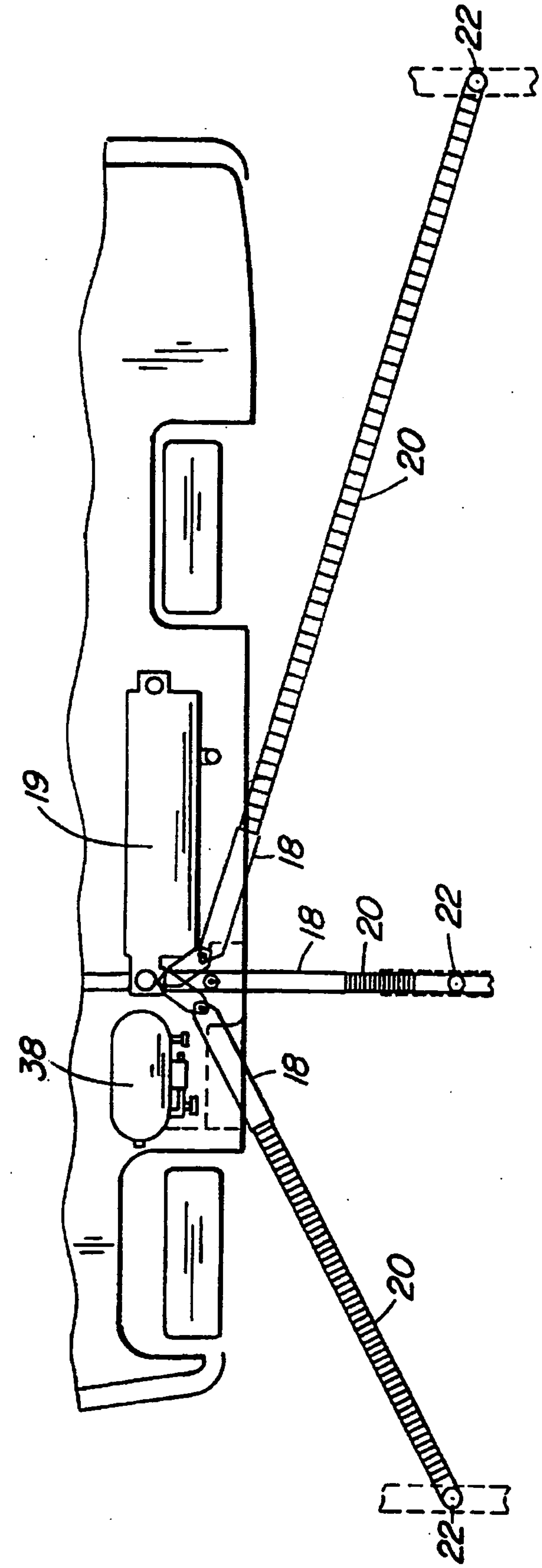

FIG. 3

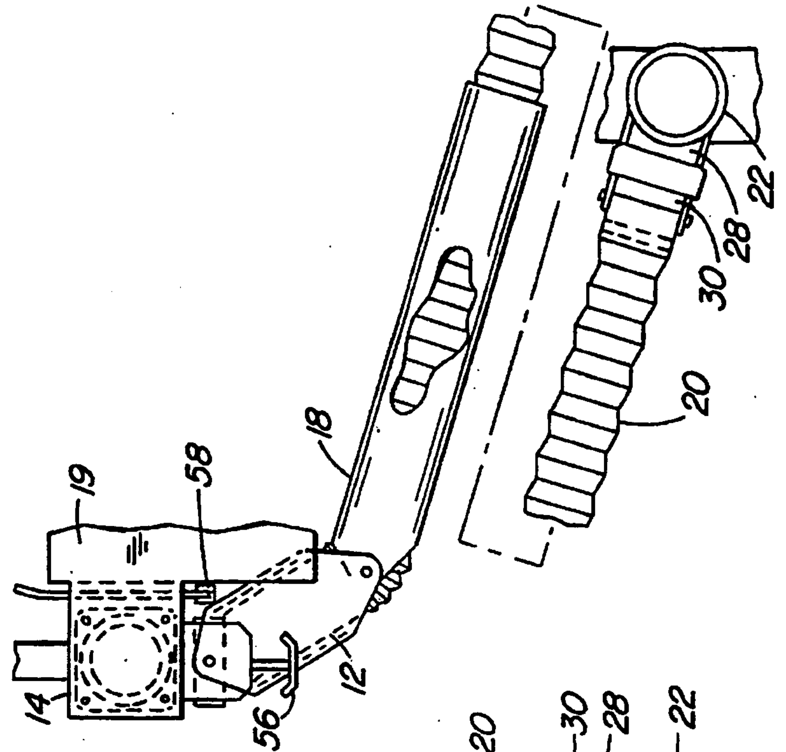

FIG. 3C

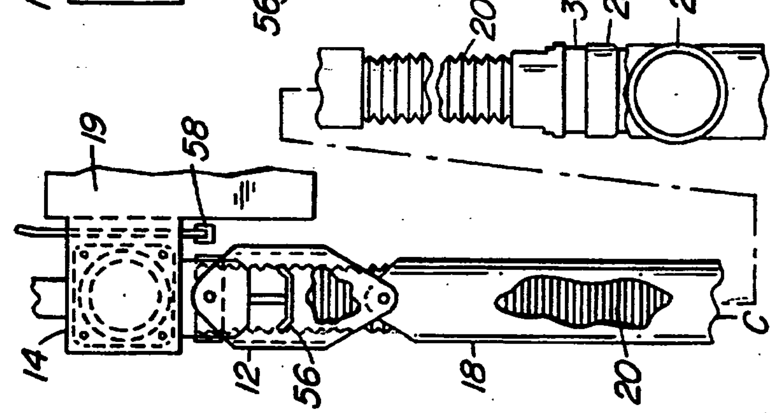

FIG. 3B

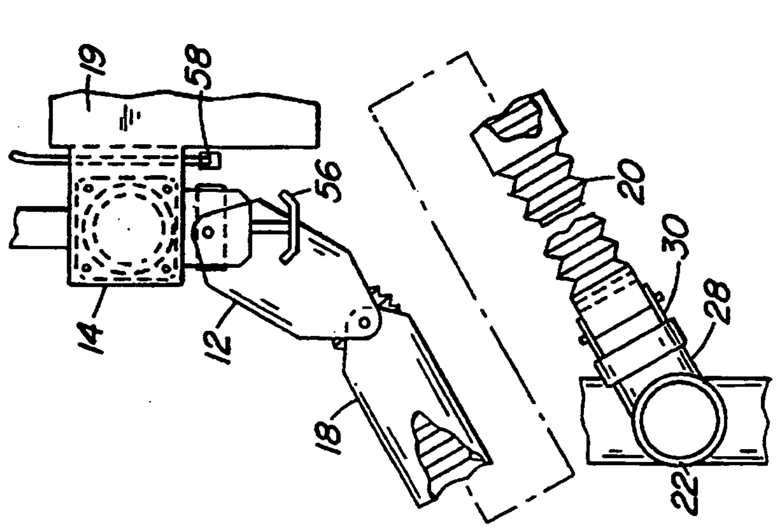

FIG. 3A

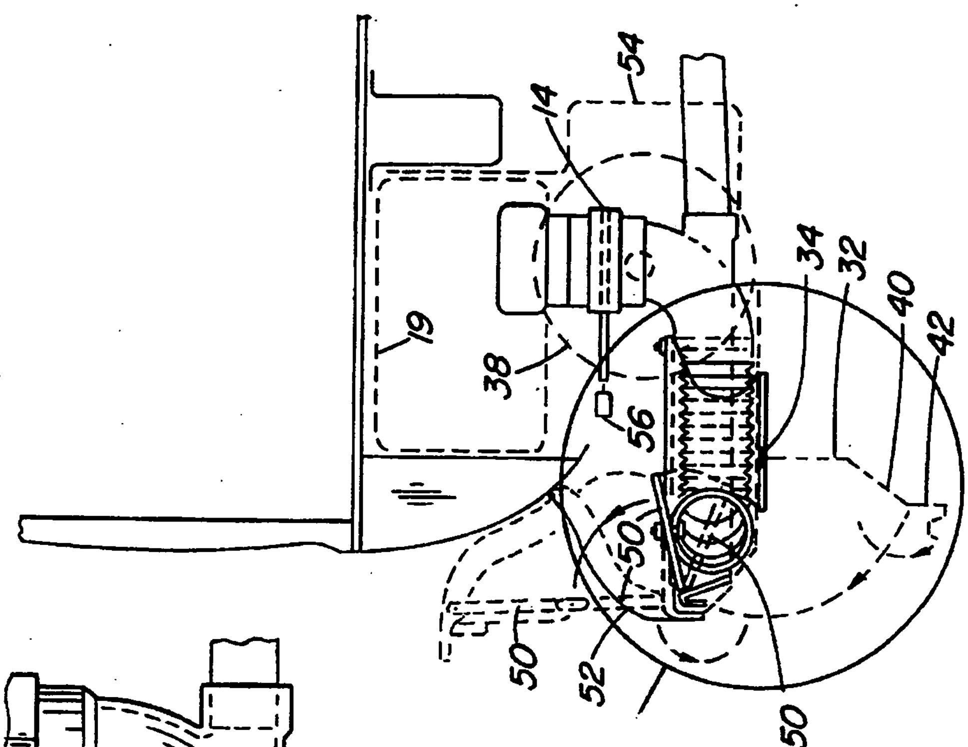
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FIG. 4

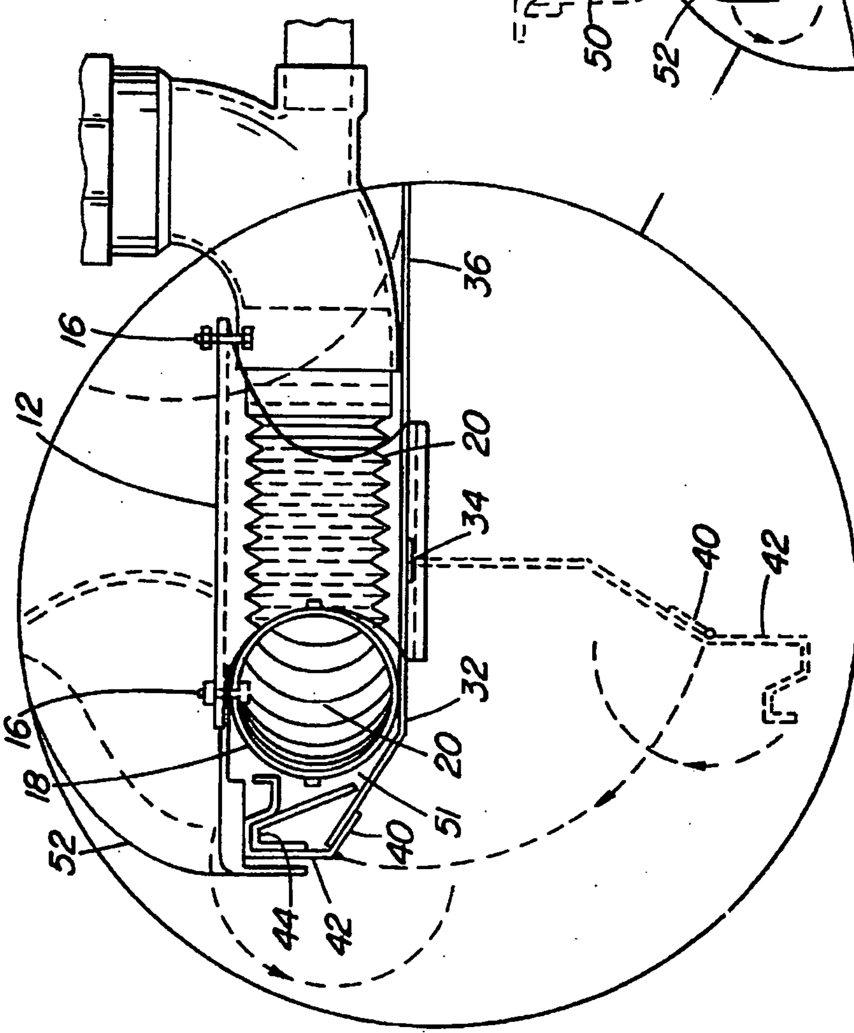
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FIG. 4A

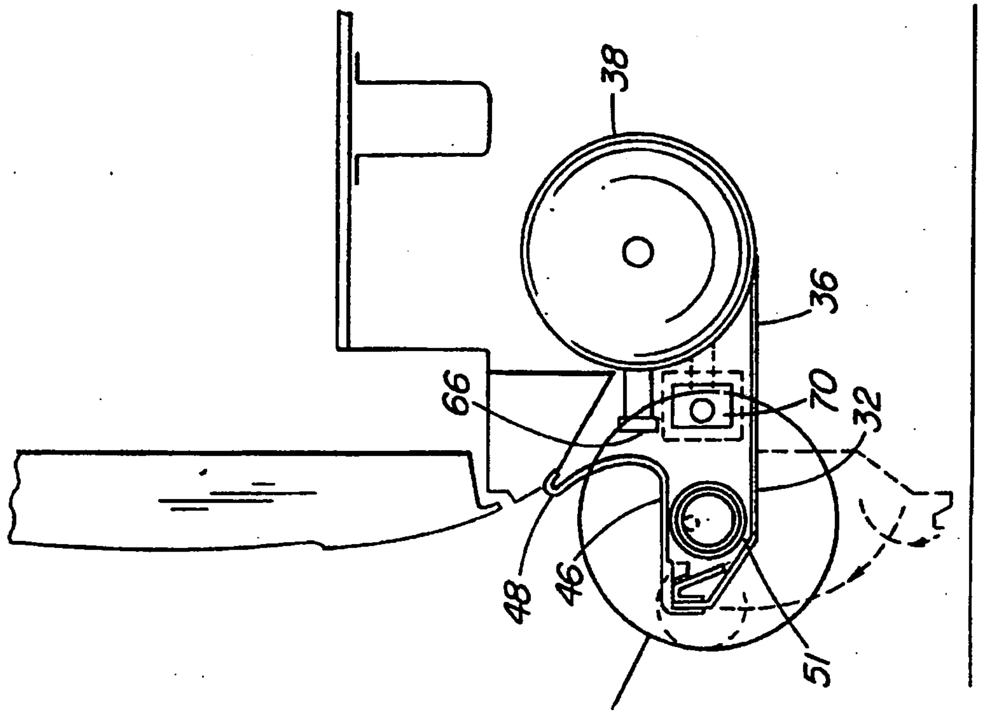

FIG. 5

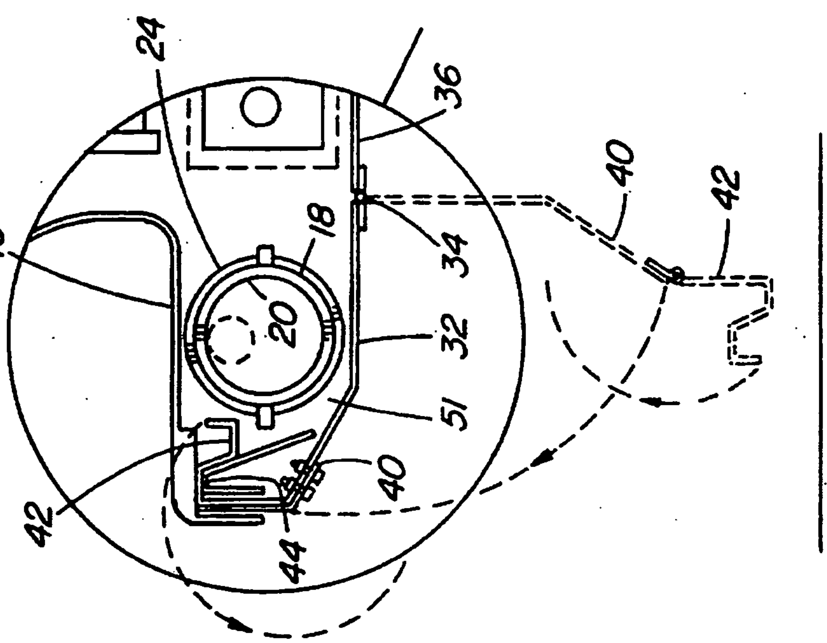

FIG. 5A

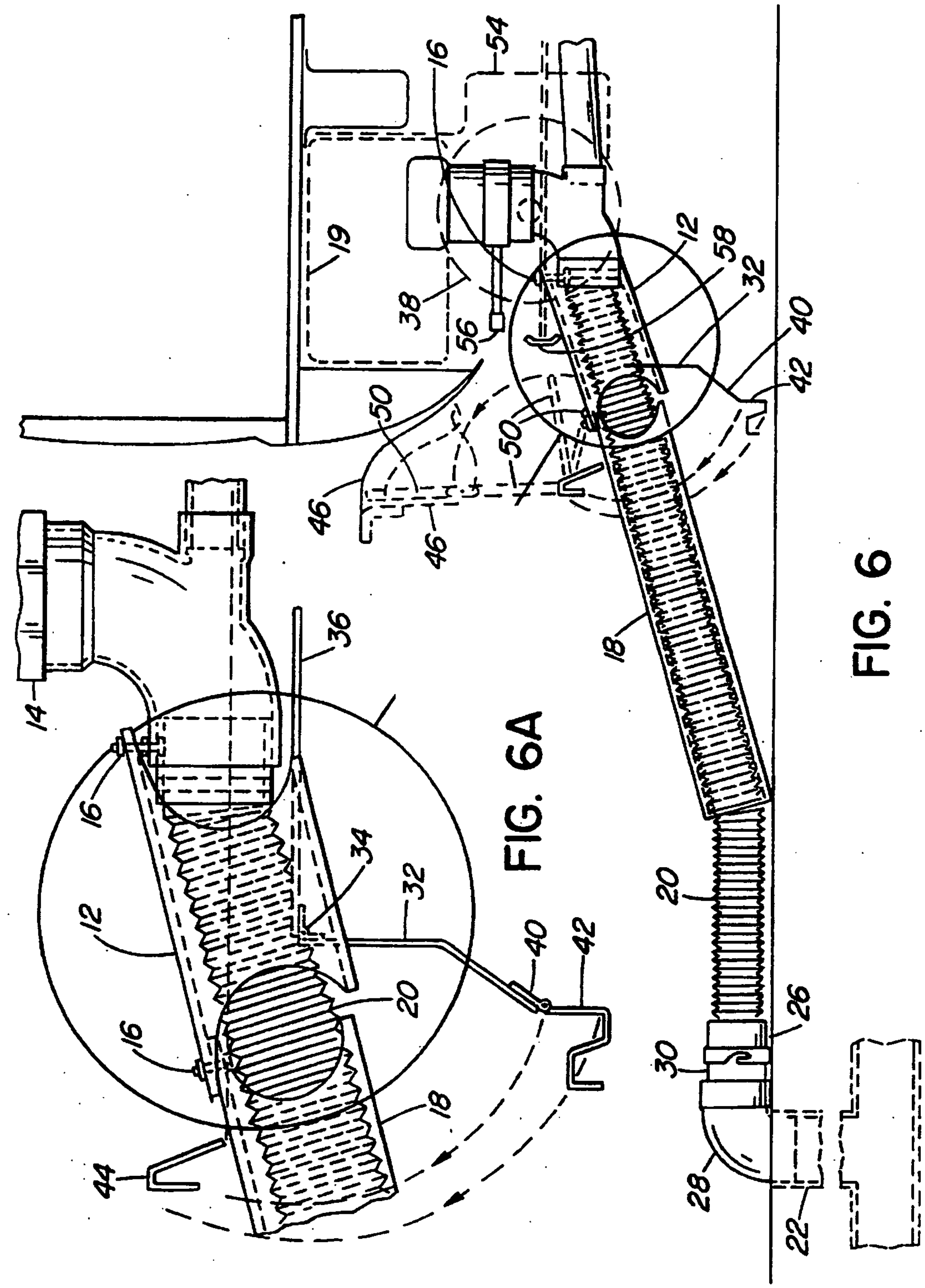

FIG. 6A

FIG. 6

SEWER DISCHARGE AND STOWING SYSTEM FOR A RECREATION VEHICLE

BACKGROUND OF THE INVENTION

This invention relates to an improved waste drainage and stowing system for recreational vehicles and the like.

Recreational vehicles having self-contained bathrooms and sewer systems must employ a suitable means for conducting the waste from the storage tanks to a suitable disposal receptacle. In the past many of these vehicles have employed an externally accessible housing for containing a length of hose which may be manually connected to a hose fitting on an outlet stub pipe of the vehicle waste storage tank. The other end of the hose, in use, was extended to the inlet of the disposal receptacle. This has proven to be a clumsy and a somewhat messy operation and it is necessary to handle the hose and flush out the waste after use to avoid excessive build-up of odours.

In U.S. Pat. No. 4,133,347 issued Jan. 9, 1979 to Albert Mercer, there is described a simple add-on unit which connects directly to the outlet stub pipe of the waste storage tank of the recreational vehicle. The unit includes a rigid outer cylindrical housing having one end which is arranged to connect to the existing outlet stub pipe of the waste tank. This cylindrical housing contains an axially compressible and expandable hose of the accordion type, which hose is connected at one end to that end of the housing which is connected to the stub pipe. The other end of the hose is extendible outside the housing to a disposal receptacle, such other end having an end sleeve connected to it with the end sleeve having a removable cap. This end sleeve is provided with connections so as to mount same within the end of the rigid cylindrical housing.

Reference may also be had to my related Canadian Patent No. 1,269,802 issued Jun. 5, 1990 which is closely related to the structure disclosed in the Mercer patent. A rigid cylindrical end piece is provided on the distal end of the hose, which end piece is adapted to be fitted to the end of the housing when the hose in the axially compressed stored position. The above-noted patent particularly provides a novel securement for releasably attaching this end piece to the aforementioned end of the housing.

The types of recreational vehicles with which this invention is particularly concerned are known in the industry as "Class B" recreational vehicles. In more recent years there has been a tendency to make these vehicles with downwardly extended lower side wall portions providing a type of "ground effect" skirt thereby to enhance the appearance of the vehicle and to hide from view a number of components which are secured beneath the floor of the vehicle. Insofar as the waste drainage attachments are concerned, there are a number of pivoting, rigid and telescoping waste drainage systems which have been used over a number of years up to the present. These existing systems however have a number of problems. The rigid systems must be connected to the storage tank at a point low enough to allow the drainage pipe to clear the lowermost edges of the sidewall of the vehicle when the drain pipe is extended outwardly. This is not feasible when utilizing vehicles with relatively low "ground effect" side walls as noted above. If the sidewalls are made to be high enough for a drainage pipe to clear its bottom when extended, the pipe can then be seen when stowed away, this obviously being undesirable from at least the appearance point of view. It is therefore desirable to have a waste drainage attachment coupled with a suitable stowing or storage system in order that the drainage system will be out of view when stored away, which may be handled very simply by the user and which is very economical to manufacture. At the same time the system should be arranged so that it can be utilized on recreational vehicles with low "ground effect" side wall portions or skirts as noted above.

SUMMARY OF THE INVENTION

A basic object of the invention is to alleviate the problems noted above and to provide a waste discharge system which can be securely stored out of sight above the minimum road clearance of the vehicle sidewall and which can be lowered and put into use in a relatively simple operation while clearing the bottom of the vehicle sidewall when extended for use.

According to one aspect of the invention there is provided a recreational vehicle or the like including a vehicle body having opposed sides and a waste storage tank with an axially extendable flexible hose connected to a waste outlet of said tank, said waste outlet being at a lower portion of the body adjacent one of the sides thereof. An elongated tubular housing is provided within which said flexible hose extends such that the hose can be stored in said housing and also drawn outwardly of a distal end of the housing toward a waste receptacle. The housing has an articulated connection at a proximal end thereof adjacent said waste outlet to enable said housing to be articulated relative to the body of the vehicle from a storage position wherein said housing extends generally parallel to said one of said body sides to a use position wherein said housing extends outwardly from said one side of the vehicle body.

In a further aspect of the invention there are provided structures defining a storage compartment extending partway alongside said one side of the body and adapted to receive said housing and said extendible hose and to define the storage position thereof.

In a still further aspect of the invention the storage compartment is defined in part by a trap door which supports said housing and hose when closed and which can pivot downwardly below the vehicle body to release said housing from said compartment following which said housing can be moved together with said hose so as to extend outwardly from the vehicle body.

Still further according to another feature of the invention said storage compartment also includes an upper door which can be opened to gain access to said compartment and to permit release of said trap door to allow it to pivot downwardly.

According to a still further feature of the invention said upper door is shaped to define a step to facilitate entry into the vehicle body, the step-door thus defined being pivotally mounted for movement from a lower step-providing position overlying the top of the storage compartment to a raised position wherein access to the interior of the storage compartment is gained.

In a preferred form of the invention a fixed rail extends along said one side of the vehicle body and outboard thereof for supporting said step-door when in the down, step-providing position. Preferably, said trap door has hooks hingedly affixed thereto along an outer edge thereof and adapted to be hooked onto said fixed rail to releasably secure said trap door in the raised housing and hose supporting position. Furthermore, said step-door, in the down position, preferably overlies said trap door hooks to substantially prevent accidental release thereof from said rail.

As a still further aspect of the invention said vehicle includes downwardly extended lower side wall portions and

said proximal end of said elongated housing includes a relatively short housing section loosely pivotally connected between said tank waste outlet and the remaining section of said elongated housing to permit said housing sections to drop downwardly by a selected distance below the waste tank outlet so as to clear bottom edge portions of the vehicle lower side wall portions when said elongated housing is moved to an outwardly extending position relative to the vehicle sidewall.

Preferably said relatively short-housing section has tapered or wedge shape ends to allow a substantial degree of articulation of the housing sections relative to one another and to said tank waste outlet.

Another feature is a shield element for retaining the hose within the housing when the latter is in the storage position.

In a preferred embodiment of the invention, plural tubular housing sections are flexibly linked together and to the waste storage tank outlet, these housing sections serving to house the axially compressible and extendible discharge hose. The flexibly linked housing sections can drop downwardly sufficiently when in use as to clear the bottom edge of the vehicle sidewall while at the same time allowing these housing sections to pivot through a substantial horizontal angle depending on the location of the sewer receptacle on the surface of the campground (which could be fore or aft of the vehicle or anywhere in between). There is also provided a hinged, generally horizontal, trap-door mounted under the driver entrance step which supports the housing sections and the hose contained therein out of view when not in use. A pair of T hinges, the leg wings of which are bent to form hooks, are hooked over a rail supporting the driver's door entrance step to secure the trap door in the closed position. This step (also referred to herein as a step-door) is also hinged for pivotal movement upwardly and downwardly. The step-door in its downward position prevents the hooks from becoming accidentally undone and provides access to the storage system when it is lifted upwardly. A bracket is associated with the step-door for retaining the step-door in both the raised and lowered positions.

Further features of the invention will become readily apparent from the description which follows taken in conjunction with the appended drawings and claims.

BRIEF DESCRIPTION OF THE VIEWS OF DRAWINGS

FIGS. 1 and 1A are elevation views of the driver's side of the vehicle showing the drainage system in its stowed position; (the details can be more clearly seen in the enlarged section of FIG. 1A it being realized that certain features are shown in full lines even though in fact they are hidden from view in the actual structure);

FIGS. 2 and 2A are top plan views taken just below the floor of the vehicle also showing the system in its stowed position together with the liquid propane and waste holding tanks. Certain details can be seen best in the large section of FIG. 2A;

FIG. 3 is a partial top plan view below the floor of the vehicle on the driver's side showing the drainage system connected to three possible locations (or anywhere in between depending upon the location of the inground sewer receptacle in the camp site);

FIGS. 3A, 3B and 3C are partial top plan views of a portion of the waste drainage system when articulated to each of the three positions shown in FIG. 3;

FIGS. 4 and 4A are cross-sections taken along line 4—4 in FIG. 2 and showing a portion of the system in its stowed position; (the step door and trap door also being shown in dashed lines in their open positions upwardly and downwardly respectively, and waste and liquid propane tanks and an exterior storage compartment also being shown in dashed lines); FIG. 4A is an enlargement of a portion of FIG. 4 for purposes of showing details more clearly;

FIGS. 5 and 5A are cross-section views of part of the vehicle and system taken along line 5—5 in FIG. 2 (the trap door being shown in dashed lines in its lowered position together with the T-hinges). Again FIG. 5A is an enlargement showing certain details;

FIGS. 6 and 6A are cross-section views of the drainage system in its extended in-use position connected to an inground sewerage receptacle shown at line 6—6 in FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The waste drainage attachment **10** is shown in FIGS. **1** and **2** as being mounted in a stowed position under the recreational vehicle **11**, the latter having downwardly extended lower side wall portions **13** which hide from view the several components secured beneath the vehicle floor including the black and grey waste holding tanks **17**, **19** respectively as best seen in FIG. **2**. The drainage attachment includes a short tubular housing **12** with tapered or wedged ends pivotally connected to a waste outlet valve assembly **14** by a bolt with spaced nuts **15** so that the short tubular housing **12** is connected loosely enough to pivot relative to valve assembly **14** upwardly, downwardly and horizontally. Similarly a longer tubular housing **18**, with one end tapered or wedged, is also pivotally connected to the other end of the short housing **12** by a bolt with spaced nuts **16**, also loose enough for relative pivoting motion as described above.

An axially compressible and extendable flexible accordion hose **20** having its inner end secured to the valve assembly **14** in the usual way is stored within both the shorter and longer tubular housings **12** and **18**. Hose **20** can be axially extended such that the opposite distal end of said hose **20** may be brought outwardly of the distal end of the longer housing **18** and made to communicate with an in-ground waste receptacle **22** as shown in FIGS. **3** and **6**. (This can be done after removing the end cap **24** from a cylindrical end piece **26** attached to the flexible hose **20** and attaching a 90 degree plumbing ELL **28** in a similar manner as the cap **24**). The ELL **28** has a cylindrical end piece **30** secured to its female end. The end piece **30** has the same type of connection as the end cap **24**. The male end of the ELL **28** is simply inserted into the sewer waste receptacle **22** during use.

The trap door **32**, for supporting the drainage attachment **10** in its stowed position, is hinged by hinge **34** on one side of the door to the skid shield **36** fixed just below the liquid propane tank **38**. T hinges **40** are attached to the opposing side of the trap door **32** with the leg wings being bent to form hooks **42**. Hooks **42** are hooked over the fixed rail **44** which extends along the side of the vehicle body and outboard thereof and which rail supports the driver entrance step-door **46** in the down position, thereby keeping the trap door **32** and the drainage assembly **10** lying thereon securely supported.

The driver entrance step-door **46** is of a 90 degree angled shape for about two thirds of its length and is hinged by hinge **48** along the top of the vertical (when seen in the closed (lowered) position) leg of the angle. This step-door **46** is held open (up) by a collapsible (folding) bracket **50**. This bracket **50** also keeps the step **46**, when down, in a

secure latched position by simply pulling the collapsed bracket **50** a little downwardly and off-centre relative to its pivotally attached ends. This can be achieved by reaching under the step-door **46** to gain access to the bracket. The other one-third of the driver entrance step-door **46** is curved outward at **52** to align with the exterior storage side access door **54**. The full length of the driver entrance step-door **46** when up (open) gives a person access to the small partially closed storage compartment **51** effectively defined between the step-door **46** and the trap door **32** when both of the latter are in their closed positions. Hence, when step-door **46** is open the user can readily unhook the T hinge hooks **42** to lower trap door **32** and gain access to discharge valve pulls **56** and **58**, drainage attachment **10**, fill valve **66**, shut-off valve **68**, regulator **70** and other items attached to the liquid propane tank **38**.

The flexible hose **20** and its end piece **26** is held in the long tube **18** by a vertically disposed forwardly located splash shield **60** which runs from the liquid propane tank **38** to the rail **44** supporting the driver entrance step-door **46**. This splash shield **60** avoids the need for a latching device and thereby provides ease of operation by not having to latch or unlatch the hose **20** every time the drainage attachment **10** is put into use and then stored in the compartment **51**.

Reference may be had in particular to FIGS. **6** and **6A** which show the in-use configuration of the system. The step-door **46** is in the open (raised) position and held there by bracket **50** and the trap door **32** is in the lowered open position as well. The flexibly linked together tubular housing sections **12** and **18** are angled downwardly from the outlet valve assembly **14** as to pass beneath the downwardly extended body sidewall at that point even though valve assembly **14** is almost entirely above that level. Hose **20** and its outlet **ELL28** extend into the waste receptacle as described previously.

To stow the system is simple. The hose **20**, after closing the valve **14** and flushing, is axially compressed into the tubular housing sections **12** and **18** and the latter is swung around parallel to the vehicle side wall with the trap door **32** then being raised and the hooks **42** hooked to rail **44** to support the drainage attachment **10**. The step-door **46** is then lowered to close the compartment **51** and the bracket **50** may be manipulated as described above to lock the step-door in place. Deployment of the system is essentially the reverse of the above.

A preferred embodiment of the invention has been described by way of example. Those skilled in the art will realize that various modifications and changes may be made while remaining within the spirit and scope of the invention. Hence the invention is not to be limited to the embodiment as described but, rather, the invention encompasses the full range of equivalencies as defined by the appended claims.

I claim:

1. A recreational vehicle or the like including a vehicle body having opposed sides and a waste storage tank with an axially extendable flexible hose connected to a waste outlet of said tank; said waste outlet being at a lower portion of the body adjacent one of the sides thereof; an elongated movable tubular housing within which said flexible hose extends such that the hose can be stored in said housing and also drawn outwardly of a distal end of the housing toward a waste receptacle; said housing having an articulated connection at a proximal end thereof adjacent said waste outlet to enable said housing to be articulated relative to the body of the vehicle from a generally horizontal storage position wherein said housing extends generally lengthwise of the vehicle body to a use position wherein said housing extends outwardly from said one side of the vehicle body; and a structure for supporting said housing in the generally horizontal storage position adjacent a lower portion of the vehicle body.

2. The recreational vehicle or the like of claim **1** including further structures defining a storage compartment extending part-way alongside said one side of the body adjacent said lower portion of the vehicle body and adapted to receive said housing and said extendible hose and to define the generally horizontal storage position thereof.

3. The recreational vehicle or the like of claim **2** wherein the storage compartment is defined in part by a trap door which supports said housing and hose when closed and which can pivot downwardly below the vehicle body to release said housing from said compartment following which said housing can be moved together with said hose so as to extend outwardly from the vehicle body.

4. The recreational vehicle or the like of claim **3** wherein said storage compartment also includes an upper door which can be opened to gain access to said compartment and to permit release of said trap door to allow it to pivot downwardly.

5. The recreational vehicle or the like of claim **4** wherein said upper door is shaped to define a step to facilitate entry into the vehicle body, the step-door thus defined being pivotally mounted for movement from a lower step-providing position overlying the top of the storage compartment to a raised position wherein access to the interior of the storage compartment is gained.

6. The recreational vehicle or the like of claim **5** including a fixed rail extending along said one side of the vehicle body and outboard thereof for supporting said step-door when in the down, step-providing position.

7. The recreational vehicle or the like of claim **6** wherein said trap door has hooks hingedly affixed thereto along an outer edge thereof and adapted to be hooked onto said fixed rail to releasably secure said trap door in the raised housing and hose supporting position.

8. The recreational vehicle or the like of claim **7** wherein said step-door, in the down position, overlies said trap door hooks to substantially prevent accidental release thereof from said rail.

9. The recreational vehicle or the like of claim **1** wherein said vehicle includes downwardly extended lower side wall portions and wherein said proximal end of said elongated housing includes a relatively short housing section loosely pivotally connected between said tank waste outlet and the remaining section of said elongated housing to permit said housing sections to drop downwardly by a selected distance below the waste tank outlet so as to clear bottom edge portions of the vehicle lower side wall portions when said elongated housing is moved to an outwardly extending position relative to the vehicle sidewall.

10. The recreational vehicle or the like of claim **9** wherein said relatively short-housing section has tapered or wedge shape ends to allow a substantial degree of articulation of the housing sections relative to one another and to said tank waste outlet.

11. The recreational vehicle of claim **10** further including a shield element to prevent said hose from escaping the housing when in the storage position.

12. The recreational vehicle or the like of claim **9** including further structures defining a storage compartment extending part-way alongside said one side of the body adjacent said lower portion of the vehicle body and adapted to receive said housing and said extendible hose and to define the generally horizontal storage position thereof.

13. The recreational vehicle or the like of claim 12 wherein the storage compartment is defined in part by a trap door which supports said housing and hose when closed and which can pivot downwardly below the vehicle body to release said housing from said compartment following which said housing can be moved together with said hose so as to extend outwardly from the vehicle body.

14. The recreational vehicle or the like of claim 13 wherein said storage compartment also includes an upper door which can be opened to gain access to said compartment and to permit release of said trap door to allow it to pivot downwardly.

15. The recreational vehicle or the like of claim 14 wherein said upper door is shaped to define a step to facilitate entry into the vehicle body, the step-door thus defined being pivotally mounted for movement from a lower step-providing position overlying the top of the storage compartment to a raised position wherein access to the interior of the storage compartment is gained.

* * * * *

US005697285A

United States Patent [19]

Nappi et al.

[11] **Patent Number:** **5,697,285**

[45] **Date of Patent:** **Dec. 16, 1997**

[54] **ACTUATORS FOR SIMULATING MUSCLE ACTIVITY IN ROBOTICS**

[76] Inventors: **Bruce Nappi**, 15 Northgate Park, Newton, Mass. 02165; **Donald Francis O'Brien**, 221A Ash St., Waltham, Mass. 02154

[21] Appl. No.: **576,643**

[22] Filed: **Dec. 21, 1995**

[51] **Int. Cl.**[6] **F15B 11/00**; F15B 19/00

[52] **U.S. Cl.** **91/519**; 91/530; 92/48; 92/34

[58] **Field of Search** 92/48, 92, 62, 92/63, 64, 34; 91/513, 519, 520, 525, 530

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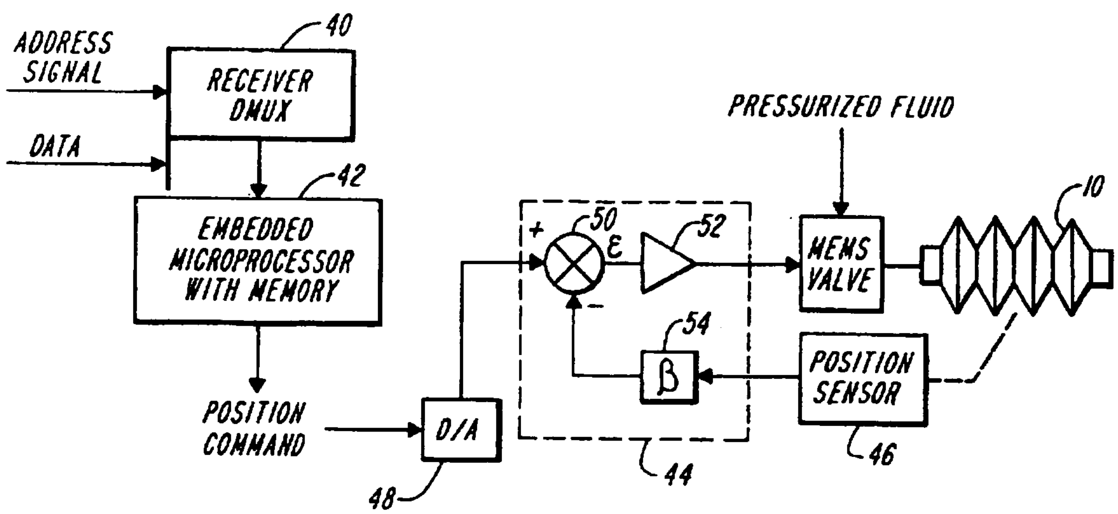
Primary Examiner—Hoang Nguyen
Attorney, Agent, or Firm—Lappin & Kusmer LLP

[57] **ABSTRACT**

An apparatus generates power at micro-scale dimensions that is sufficient to simulate the muscle activity required by the joints of robotic fingers. The apparatus includes a bellows device for generating a motion stimulus in response to pressure changes within the bellows. A configuration of programmable micromachined valves is used to regulate the flow of pressurized fluid within the bellows. A microprocessor is responsive to motion commands for controlling the operation of the apparatus. The apparatus is configured as an integrated device that is coupled to the articulations of a robotic hand via suitable attachment mechanisms.

36 Claims, 3 Drawing Sheets



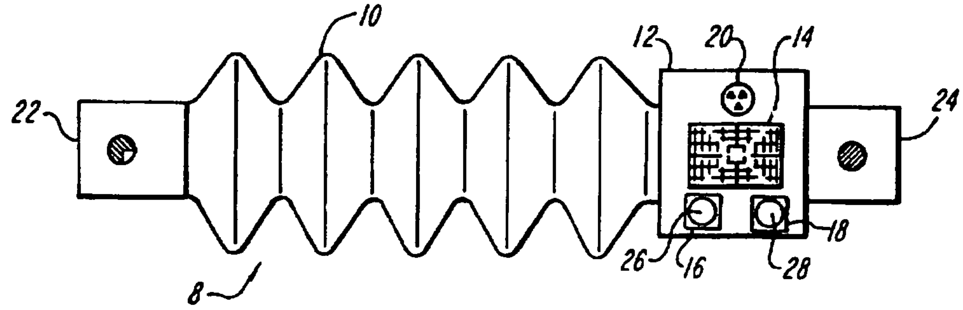


FIG. 1

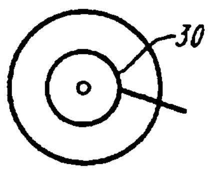


FIG. 2A

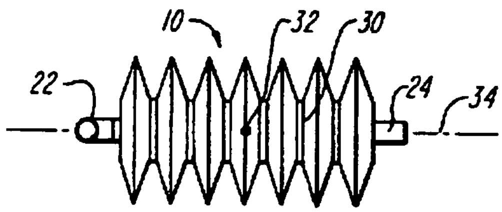


FIG. 2B

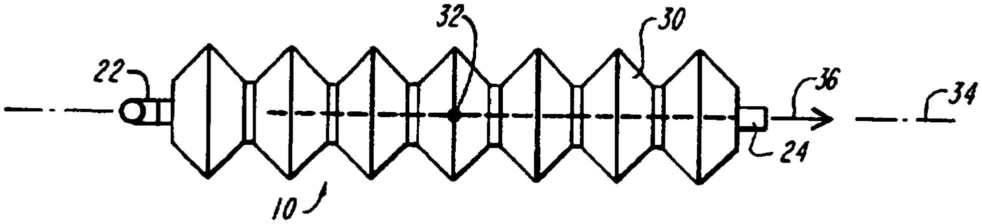


FIG. 2C

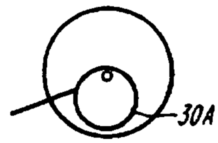


FIG. 3A

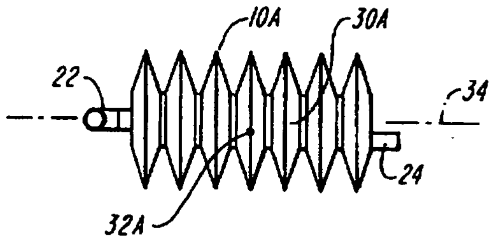


FIG. 3B

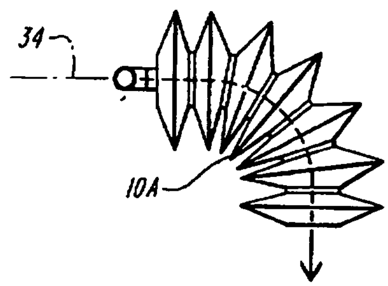


FIG. 3C

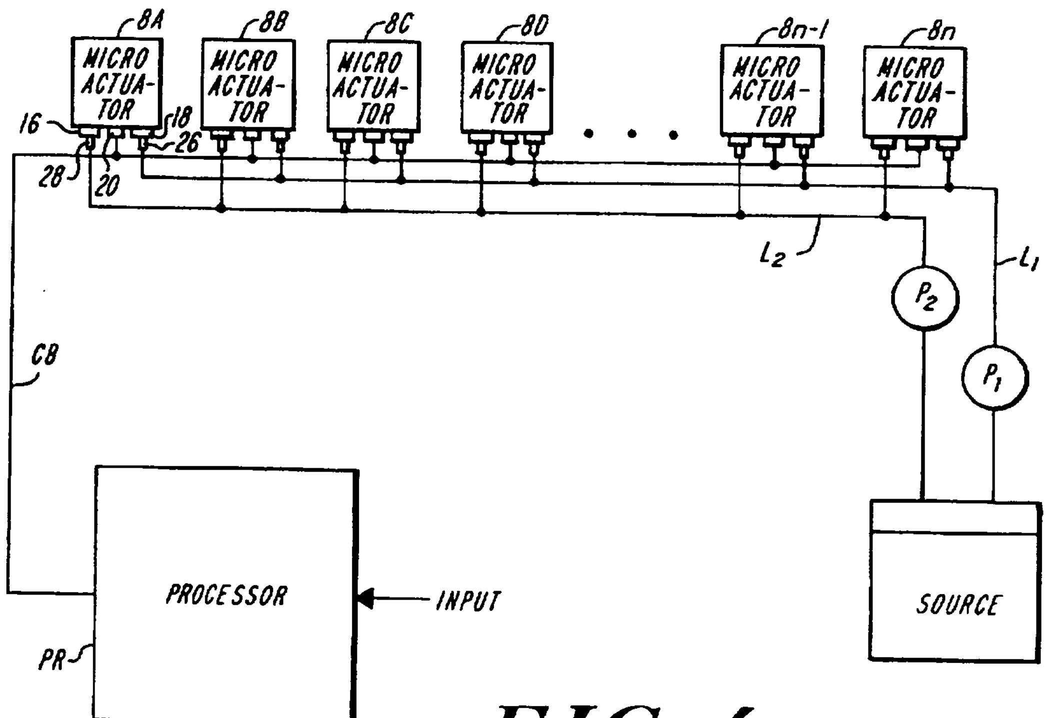
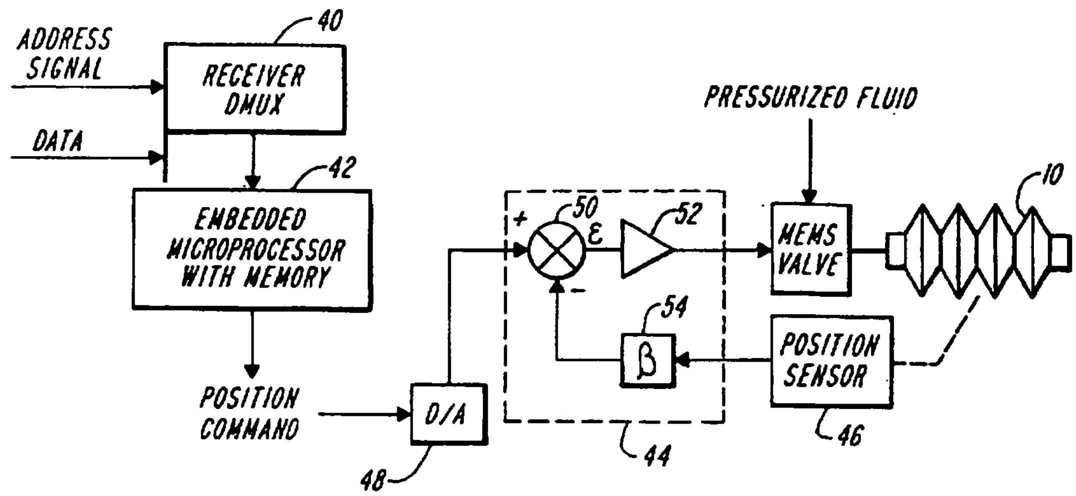
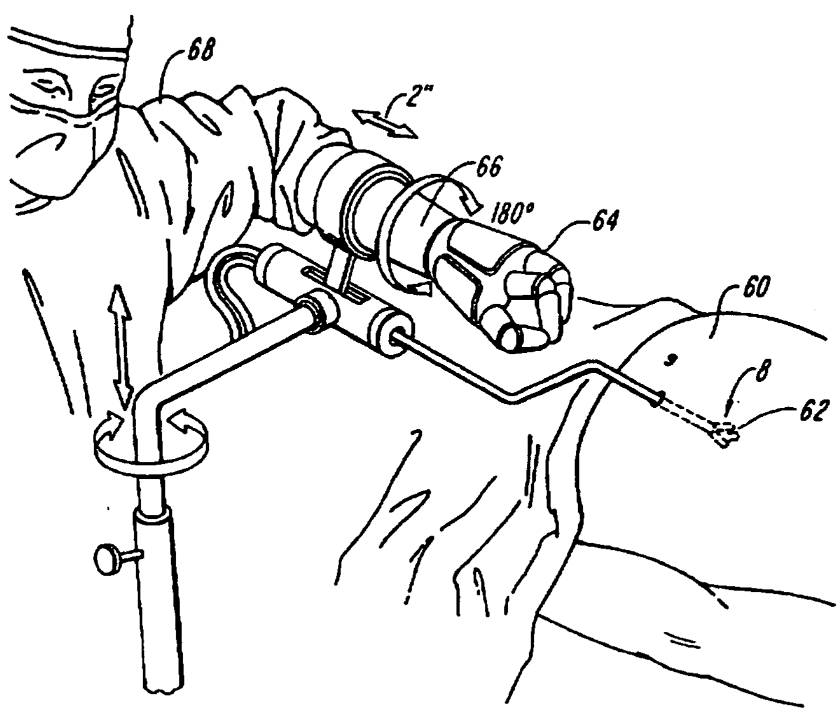


FIG. 4



ADDRESS SIGNAL
DATA
40
RECEIVER DMUX
42
EMBEDDED MICROPROCESSOR WITH MEMORY
POSITION COMMAND
D/A
48
+
50
ε
52
−
54
β
44
PRESSURIZED FLUID
MEMS VALVE
10
POSITION SENSOR
46

FIG. 5



68
2"
66
180°
64
60
8
62

FIG. 6

ACTUATORS FOR SIMULATING MUSCLE ACTIVITY IN ROBOTICS

FIELD OF THE INVENTION

The present invention relates to the development of power delivery modules capable of generating force components on a micro-scale dimension and, more particularly, to a microactuator assembly that duplicates muscle activity, particularly those provided in the digital extremities of the human body, thereby facilitating robotic hands, feet and limbs.

BACKGROUND OF THE INVENTION

Many minimally invasive surgical techniques have been and are being developed so that surgery can be performed inside the body with minimal trauma to the patient. Endoscopic surgery, for example, is a medical procedure in which the treatment of internal organs, such as tissue cutting, removal and repair, is performed through a long tube extending through a surgical aperture created in a patient's skin or through a natural orifice of the patient's body. These procedures are accomplished with long thin tools inserted through or contained within the endoscope. Often using a miniature camera attached to the endoscope, the internal surgical field can be observed during the surgical procedure. When performed on the abdominal cavity, the endoscopic system is called a laparoscope and the procedure is termed laparoscopic surgery. When performed on the joints, such as the knee, the endoscopic system is called an orthoscope and the procedure is termed orthoscopic surgery.

These minimally invasive surgical techniques, such as laparoscopic surgery, have received wide acceptance among patients and doctors because of significantly lower incidence of post-operative complications attributable to reduced incision trauma. The benefits of this procedure include quicker recovery times and less patient monitoring, leading to shorter hospital stays and consequent reductions in medical costs. Despite all of these advantages, endoscopic surgery still presents the surgeon with several formidable challenges.

In accordance with current medical practice, certain endoscopic surgical techniques, such as those encountered in laparoscopic and orthoscopic surgery, require the surgeon to operate in a counterintuitive manner that is attributable to the coordination transformation that occurs as the remote end of the endoscope is inserted into and maneuvered within the patient. At present, the surgeon must position and use surgical tools at the remote end of an endoscopic tube, for example in the case of a laparoscope approximately 500 mm long and usually 11 mm in diameter. The tube is moved into position by pivoting it at a fulcrum formed at the point of entry into the patient's skin. This fulcrum pivot requires the surgeon to undertake an inverted sequence of the particular hand motions which would otherwise be appropriate during manual handling of the remote end of the endoscope. For example, if the remote tip inside the body must be moved upward and to the right, the surgeon's hand outside the body must then move downwards and to the left. This mismatch in orientation is further complicated by attempts to coordinate these motions against an image being displayed on a TV monitor, which itself may change in orientation as the camera is rotated. This difficulty represents a major obstacle to widespread use of this surgical method, significantly increasing the actual procedure time for the surgeon.

One example of an endoscopic positioning apparatus used in laparoscopic surgery is disclosed by Begin et al. in "A Robotic Camera for Laparoscopic Surgery: Conception and Experimental Results," *Surgical Laparoscopy & Endoscopy*, Vol. 5, No. 1, pp. 6–11 (1995). Begin et al. propose a robotic surgery system that includes a robotic arm for manipulating a laparoscopic camera. A universal joint is inserted between the end effector of the robotic arm and the camera handler to implement two passive degrees of freedom that prevent arm motions from generating injurious torquing forces that otherwise would develop if the camera was rigidly attached to the robotic arm. The motion of the robotic arm is mathematically represented by three variables to define a spherical displacement model: an alpha angle (α) corresponding to the camera orientation (right or left); a beta angle (β) corresponding to the camera altitude (up or down); and a radius value (R) corresponding to laparoscopic penetration (in or out). Based upon a visual inspection of the operating field acquired by the laparoscopic camera, the image may be reoriented using a computer subsystem that calculates the proper orientation variables α, β, and R for the camera, and then transforms these values into a series of robotic arm motions that are sufficient to produce the desired camera orientation. The robotic arm is instructed to move in accordance with these computed arm motions. However, its operation is limited by the absence of a suitable power delivery system capable of duplicating the muscle activity that controls movement of the human fingers.

Another example of an endoscope positioning apparatus that can be used in laparoscopic surgery is described in copending U.S. patent application Ser. No. 08/525,273, filed by Bruce Nappi and John Coller on Sep. 7, 1995, and entitled Apparatus for Positioning and Moving an Endoscopic Instrument (Attorney's Docket No. LC-6).

In all of these endoscopic systems, the manipulation of the surgical tools provided at the remote end of the endoscope during the surgical procedure is typically accomplished with one or two degrees of freedom, resulting in the necessity of requiring the remote end of the endoscope to be moved around to insure proper positioning of the surgical tools. A system that allows the physician to precisely maneuver surgical tools at the remote end of an endoscope is therefore extremely desirable. Such a system would necessarily involve the robotic manipulation of these endoscopic tools (e.g., the manipulation of robotic fingers attached to an endoscope), and ideally duplicate the movements of the human hand, with all six degrees of freedom, and preferably capable of accomplishing very small micro-manipulative steps with great dexterity.

Generally, robotic assemblies are typically configured with end effectors having a mechanical design which complements the task being executed. For example, a robotic arm may be provided with a gripper hand matched to the contours of its payload. A diverse array of parts can be handled if the robotic arm is fitted with one of a variety of releasable wrist members each designed to support a particular payload. Robotics technology may also be employed to emulate a particular structure of the human anatomy, thus simulating a specified human action.

In applications involving the simulation of a human activity, the structural and operational aspects of the robotics assembly ideally are made to conform to the anatomical features underlying the chosen human capability. Since the human hand is the anatomical structure responsible for producing very precise and controllable motions at small dimensions, robotics research has focused upon designs intended to duplicate the functioning of the human hand, specifically the fingers. For example, the implementation of a prehensile (i.e., grasping) motion involves the use of

robotic fingers that simulate the individual phalanx members comprising the digital extremities of the human hand.

By way of background, the mutual linkage of bones in the human skeletal system is accomplished by a connection known as a joint or articulation. In a movable articulation, the joint is formed by the coupling of two contiguous bony surfaces whose articular extremities are covered by cartilage and connected together by ligaments consisting mainly of bundles of white fibrous tissue. A physical structure modeled after such a connection is well known in the art, e.g., an interconnection of robotic fingers imitating the digital extremities of the human hand. In general, robotics research has succeeded in developing devices that structurally reproduce the physical aspects of the phalangeal articulations. For example, the Utah-MIT robotic hand and the Salisbury robotic hand are representative of robotic structures having multi-jointed fingers that can emulate the grasping ability of a human hand.

A precise robotic reproduction of the human hand requires not only that the physical structure be emulated, but also that the robotic fingers function with the same characteristic motion demonstrated by human fingers. Although current robotic assemblies show great promise for moving workpieces within the geometrical space of manufacturing environments, existing limitations prevent the development of workable prehensile end effectors which are specifically adaptable to the precise maneuvering of instruments at micro-scale dimensions. The principal challenge involves the design of an adequate, yet inexpensive control apparatus capable of manipulating the robotic fingers so that they fluidly and precisely emulate the motions permitted by the phalangeal joints, i.e., both flexor and extensor motions. In particular, the desired degree of precision requires a control apparatus that can perform the muscle activity needed to implement the joint motion. This search for a control apparatus capable of delivering sufficient power to simulate the muscle activity is made even more difficult by the need to produce such power on micro-scale dimensions. One useful design approach that addresses this problem involves identifying the anatomical structures responsible for joint motion and then constructing an apparatus which emulates the identified structure, as described below.

The anatomical motions permitted by the joints are controlled by a network of muscles whose connection with the bones and cartilage is accomplished either directly or indirectly through the intervention of fibrous structures called tendons. Accordingly, the relevant anatomical structure for purposes of designing such a robotic power delivery system is the muscle and tendon group that interconnects the phalanx members (i.e., fingers) at the digital extremities of the upper human torso. A need therefore exists to manufacture a suitable robotic system for simulating the muscle activity at the finger joints of the human hand, and which is particularly useful in the manipulation of surgical instruments.

Achieving large forces and small motions in a small volume with a robotically controlled hand has always been a formidable and complex task. The problem becomes even more complicated as additional fingers and joints are included to increase the dexterity and therefore expand the range of motion and degree of control with multiple degrees of freedom. Nevertheless, the employment of a multifunctional tool is desirable because it provides an opportunity for eventually reducing the number of individual tools required to complete any task. Therefore, for each application, the selection of an appropriate robotic power delivery system to deliver adequate motive energy is a significant task. The principal technologies currently in use include linkages, "tendons" and electric motors.

Linkages are often used in robotic hands designed for limited degrees of freedom (e.g., single fingers with one or two joints), and may be configured as push rods and rotary shafts. Although additional degrees of freedom are possible with more rods, each additional rod imposes a dimensional reduction upon its size, where dimensions are constrained as in the remote end of an endoscopic tool. In particular, since the system design typically requires that the overall envelope dimensions remain the same, an increase in the number of rods decreases the available rod diameter. This reduces the ability of each rod to transmit power. Accordingly, linkage mechanisms are not suitable for applications where power must be transferred to tools which require even a modest number of degrees of freedom.

"Tendons" are the most commonly used means of power and control delivery in robotic hands, and are typically configured as single strands of wire which substantially reproduce the tendon structure in human hands. Tendons represent a suitable structure for delivering robust quantities of power from one location to another, particularly in combination with sheaves, bellcranks, and other such devices which allow the tendons to support a wide range of motion over a considerable distance. However, tendon structures are limited because they must be powered by an assembly of power sources such as motors which are currently unacceptably large for the desired micro-scale applications. Each moving element requires an individual tendon and power source. Due tc their relatively large size, the actuators are typically assembled into a large package located remote from the element they actuate, requiring a very long tendon to transmit the necessary force.

Electric motors offer numerous advantages such as relatively low cost, availability as a stand-alone operating unit, and amenability to installation and direct integration with electronic controllers. However, conventional miniature electric motors simply cannot provide adequate power for the vast majority of robotic systems such as those that must rapidly maneuver a surgical instrument grasped by a robotic hand. Instead, electric motors are primarily used in applications where very low motive force is required, e.g., when slow robotic finger movement is acceptable.

In summary, conventional power delivery systems are inadequate for the operations needed in small-scale robotics applications. Recently, however, power delivery systems using fluidics have received attention. The use of fluids to deliver power is attractive because of their ability to produce high motive energy and their capacity for deployment in a diverse range of applications.

Fluid power has traditionally been used in large-scale applications, such as with cranes and construction equipment. Fluidic systems have also been employed in small-scale operations, including machine automation, grasping fixtures, and diverting workpieces on conveyor belts. However, fluid-based approaches are often passed over for robotic designs because the auxiliary equipment needed to generate and deliver adequate fluid flows is larger than electrical systems. There is also a reluctance to use fluid power in sterile conditions such as surgical operating facilities, primarily because fluids are considered messy and may be difficult to contain due to their rapid diffusion, creating a risk of compromising the integrity of the operating room and possibly infecting the patient. Furthermore, since many robotic systems are usually designed by electronic and computer engineers, many of the robotic designers are less familiar with the field of fluidics.

Certain hydraulic devices for delivering energy to remote sites of reduced dimensions for accomplishing a surgical procedure nevertheless have been suggested. These configurations have generally used a bellows or piston-like element to transform hydraulic power into a motion stimulus for moving tools or instruments. Examples of such bellows configurations are set forth below.

In one conventional configuration, the bellows is used to impart an axially reciprocating motion that alternately advances and retracts a work element coupled to the bellows. U.S. Pat. No. 3,884,238 to O'Malley et al. discloses a bellows responsive to the alternate application of compressed air and vacuum pressure for creating a reciprocating motion that axially translates a telescoping tube. The tube is fitted with a sharpened edge for cutting diseased tissue, facilitating the removal of cataracts during eye surgery. U.S. Pat. No. 4,986,827 to Akkas et al. employs a diaphragm assembly (i.e., bellows device) in a similar manner, imparting a reciprocating motion to a cutting instrument. U.S. Pat. No. 5,024,652 discloses an ophthalmological resection device employing a hydraulic system (i.e., bellows and hydraulic pipe) that is responsive to depressions of a surgeon-operated foot pedal to actuate the bellows, causing the bellows to develop a reciprocating linear motion within a cutting tool that effects the removal of tissue from a body cavity. U.S. Pat. No. 5,217,465 to Steppe describes a flexible and steerable aspiration tip that is suitable for microsurgical procedures. Specifically, the aspiration tip is configured with a bellows adapted to reciprocate within a chamber in response to pneumatic pressure changes, thereby supplying a linear motion which translates the tip between its flexor states. U.S. Pat. No. 5,314,408 to Salmon et al. discloses a vascular catheter system configured with an axially expandable member (i.e., bellows) for reciprocatably advancing or retracting a workpiece (e.g., ultrasonic transducer) attached to the distal end of the catheter body.

In another category of bellows configurations, the bellows is used to adjust the position of an attached work piece. For example, in U.S. Pat. No. 2,800,055 to May, a hand control unit is equipped with a telescopic control lever whose motions produce either a discharge or injection of pressurized fluid within the bellows assembly. The resulting bellows movement displaces an array of blocks that subsequently exert a force against a holder mechanism carrying a surgical instrument. U.S. Pat. No. 4,946,329 to Krueger similarly discloses a micromanipulator for making precise, reproducible adjustments to the position of a mechanical element. Specifically, an hydraulically-operated bellows member is placed in operative engagement with a lever arm secured to a platform. Motion of the bellows member produces microadjustments to the platform, thereby maneuvering a microtool supported by the platform.

In yet another hydraulic system based upon bellows, U.S. Pat. No. 4,056,095 to Rey et al. discloses a control device implantable in a sub-cutaneous region and actuated by pressure applied to the overlying skin. The control device includes a set of coaxially-disposed bellows adapted at respective ends for hydraulically communicating with a fluid chamber and with an inlet-outlet port serving as a nozzle for a flexible duct (e.g., an artificial sphincter muscle). As pressure is applied to the skin, fluid from the chamber is forced into the bellows arrangement to create a reciprocating motion that communicates pressure changes through the inlet-outlet, causing the flexible duct to alternately open or close. Hence, the bellows arrangement is useful in actuating an artificial duct which itself defines the passageway into an intra-corporal orifice (e.g., a bladder).

Although the bellows configurations described above have uses at relatively small dimensions, including, inter alia, the resection of diseased tissue, adjusting the position of a workpiece, and actuating artificial ducts, none of the cited configurations can simultaneously produce precisely controlled motions and relatively high force, and do so without an external fluid control system in small enough size to replicate a human hand with no auxiliary motor assembly. Additionally, each bellows element of conventional use requires a separate fluid line. It is clear that the current state of bellows development has not embraced an integrated solution for providing power on a miniature scale sufficient to manipulate surgical instruments with dexterity with many degrees of freedom.

OBJECTS OF THE INVENTION

It is a general object of the present invention to obviate the above-noted and other disadvantages of the prior art.

It is a more specific object of the present invention to provide a microactuator assembly that integrates a bellows device with a configuration of micromachined valves operated by an integrated control unit to emulate a small muscle capable of both flexor and/or extensor motions.

It is a further specific object of the present invention to provide a microactuator assembly adapted for use as a micromuscle simulator to duplicate the muscle activity at a finger joint.

And another object of the present invention is to provide a system of robotically controlled microactuator assemblies capable of being grouped together to achieved dexterous motions through many degrees of freedom.

Other objects of the invention will in part be obvious and will in part appear hereinafter. The invention accordingly comprises the apparatus possessing the construction, combination of elements, and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

SUMMARY OF THE INVENTION

The foregoing and other objects will be achieved by an integrated apparatus for generating a motion stimulus, wherein the apparatus comprises:

- bellows means, responsive to a pressure condition at an input port thereof, for generating a motion stimulus;
- valve means, integrally coupled to the bellows means, for operatively regulating the application of pressure to the input port of the bellows means; and
- integral controller means for controlling the operation of the valve means.

The apparatus further comprises a pressure generation means for generating the pressure. The pressure generation means includes a source means for generating a flow of pressurized fluid, and a vacuum means for generating a vacuum pressure.

The valve means includes a first selectively operable micromachined valve adapted to admit the flow of pressurized fluid from the source means into the bellows means; and a second selectively operable micromachined valve coupled to the vacuum means and adapted to withdraw pressure from the bellows means.

The controller means includes a microcomputer.

The apparatus further comprises detection means, in motion-detecting relationship with the bellows means, for detecting a position of the bellows means; and feedback

means, responsive to the detected position of the bellows means and a position command signal from the microcomputer that is representative of a selected position of the bellows means, for adjusting the operation of the valve means.

According to another aspect of the present invention, in a robotic system including a configuration of robotic fingers, an integrated actuator assembly is coupled to the robotic fingers for displacing the robotic fingers, wherein the assembly comprises:

bellows means for generating a motion stimulus as pressurized fluid flows through an input port thereof;

valve means, in fluid communication with the input port of the bellows means, for controllably regulating the fluid flow through the input port of the bellows means; and

controller means, coupled to the valve means, for controlling the operation of the valve means.

The valve means includes a configuration of programmable micromachined valves. The controller means includes a microprocessor.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the present invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, wherein:

FIG. 1 is a schematic illustration of a microactuator assembly in accordance with the present invention;

FIG. 2A is a cross-sectional axial view of a bellows device in accordance with one aspect of the present invention;

FIGS. 2B and 2C schematically illustrate the compressed and extended phases, respectively, of the bellows device represented in FIG. 2A;

FIG. 3A is a cross-sectional axial view of a bellows device in accordance with another aspect of the present invention;

FIGS. 3B and 3C schematically illustrate the compressed and extended phases, respectively, of the bellows device represented by FIG. 3A;

FIG. 4 is a block diagram of the preferred system comprising a plurality of microactuator assemblies connected together with a common control bus and hydraulic lines for delivering liquid to and from the bellows of each assembly;

FIG. 5 is a block diagram depicting the functional components of the microactuator assembly of FIG. 1, in accordance with a preferred embodiment of the present invention; and

FIG. 6 shows a pictorial view of an endoscope designed in accordance with the present invention and shown in use.

The same or similar elements throughout the drawings are identified with the same reference numeral.

DETAILED DESCRIPTION OF THE DRAWINGS

In its most general form, the present invention is directed to an apparatus for precisely delivering motive power at micro-scale dimensions. The apparatus includes a power source capable of controllably transmitting power and further includes an actuator element for translating power from the power source into the required motion stimulus. In accordance with one aspect of the present invention, the power is transmitted through a fluid and the actuator element is a bellows device which expands and contracts in response to fluid provided to and withdrawn from the bellows device so as to simulate muscle activity (both flexor and extensor motions). More particularly, the apparatus includes a microactuator assembly utilizing a bellows device to convert a fluid under pressure (e.g., pneumatic or hydraulic, although a non-compressible hydraulic fluid is preferred), provided from a pressurized fluid source, into a force component. An integrated valve mechanism is used to regulate the pressure being introduced into or withdrawn from the bellows device, while an integrated control unit is employed to direct the operation of the apparatus.

In accordance with another aspect of the invention described in greater detail hereinafter, each valve mechanism can be selectively controlled by the control unit so that plural valves and the corresponding set of bellows can be used with a minimal one pressure fluid line, and one control bus connected to all of the control units.

Referring to FIG. 1, microactuator assembly **8** in accordance with the present invention includes a bellows device **10** and controller **12**. The controller **12** preferably includes a microprocessor controlled circuit **14** in the form of an integrated circuit for controlling the two micromachined valves, indicated generally at **16** and **18**. The valves respectively regulate the flow of fluid between bellows **10** and the pressure ports **26** and **28** which are respectively adapted to provide pressurized fluid to and receive discharged fluid from bellows **10** through the corresponding valves **16** and **18**. Each valve is normally closed. Circuit **14** is provided with unique programmable addresses for the corresponding valves **16** and **18** so that when a signal representative of one of the unique addresses is applied to the input of the circuit **14**, the corresponding valve will open. The circuit **14** also controls the length of time the valve is open so as to control the length of extension of the bellows **10**, as will be more evident hereinafter. Circuit **14** receives address and control signals via electrical connector **20** that is coupled to other circuits **14** of other microactuator assemblies using an appropriate bus connection, as will be more evident from FIG. 5 described hereinafter. Bellows **10** is configured with linking mechanisms **22** and **24** secured at respective ends thereof to facilitate attachment to other devices, such as articulated elements of a robotic finger provided to the end of an endoscope.

Bellows **10** performs the required actuator function which involves the conversion of fluid pressure into a force component. As used herein, "fluid" refers generally to a substantially incompressible substance characterized by relatively rapid diffusion. The fluid is preferably a liquid component creating a hydraulic pressure, although in some instances where the fluid can be compressible, the fluid can be a gas component creating a pneumatic pressure. This device offers numerous advantages, particularly as a component in medical applications. For example, as discussed below, the automation of endoscopic or laparoscopic surgery requires an actuator device capable of preserving the integrity of the operating room, which makes the bellows an appropriate device for implementation because it is inherently leak proof, possesses low friction and hysteresis, and does not require any sealing material.

In general, bellows **10** defines a sealed enclosure having accordion-like walls that permit the bellows to be axially expanded and contracted, allowing the volume within the enclosure to be varied in response to fluid pressure changes within the sealed enclosure. The bellows is configured with an inner chamber disposed along its longitudinal dimension, and is operationally characterized by a reciprocating motion as the fluid pressure changes within the chamber. The inner chamber is configured as a cylindrically-shaped chamber that is adapted to receive a flow of pressurized fluid during

an expansion mode, and to discharge the pressurized fluid during a contraction mode. Depending upon the placement of the chamber relative to the outer circumference of the bellows, the direction of thrust will vary accordingly. FIGS. 2 and 3 are schematic diagrams of individual bellows devices used to develop a linear and pivoting motion, respectively.

Referring to FIG. 2A, a cross-sectional view is shown along the axial dimension of a bellows device which produces a linear thrust during its reciprocating expansion and contraction motion. To achieve such thrust, the bellows is configured with an inner chamber **30** disposed concentrically in relation to the outer circumference of the bellows. Specifically, the center point **32** of the chamber **30** is coincident with the longitudinal axis **34** of the bellows. When withdrawing fluid from the chamber **30**, the bellows will exhibit the contracted form shown in FIG. 2B. As pressurized fluid is introduced into the bellows chamber **30**, the bellows becomes extended as shown in FIG. 2C, exerting a linearly-directed thrust in the direction of the arrow **36** along the axis **34**. The linear extension is specifically attributable to the concentric positioning of the chamber with respect to the bellows circumference and additional guiding means (not shown). When fluid is withdrawn from the chamber, the bellows will contract due to the spring nature of the bellows or an auxiliary spring (not shown), producing a linear force in the opposite direction of arrow **36**.

Referring to FIG. 3A, a cross-sectional view is shown along the axial dimension of a bellows **10A** which produces a rotational or pivoting thrust during its reciprocating motion. The bellows is configured with an inner chamber **30A** whose center point **32A** is displaced away from the longitudinal axis **34** of the bellows and towards the outer circumference. The inner chamber is therefore offset from the concentric placement depicted by the bellows of FIGS. 2A–C, which illustrates a linear reciprocating motion. When contracted, the bellows will take a form resembling that depicted in FIG. 2C. However, by offsetting the inner chamber in the manner described, the bellows **10A** will follow the curved or rotational motion depicted in FIG. 3C when pressurized fluid is introduced into the bellows chamber. The consequent thrust generated by this bellows during its extension mode provides both a power and bearing function.

Although the bellows device disclosed herein is represented as a diaphragm element, this representation is shown for illustrative purposes only and should not serve as a limitation of the present invention. Rather, it should be apparent to those skilled in the an that other devices may be used, such as a piston-like cylinder, without departing from the basic operation of the microactuator assembly.

The transmission of fluid into and away from bellows **10** or **10A** is regulated by a valve mechanism. In a preferred implementation, this valve mechanism is configured with micromachined valves capable of supporting microflow transmissions. These valves are adapted to be in fluid communication with the inner chamber of the bellows, depending upon the selected fluid medium. The NC-1500 Fluistor™ Microvalve from Redwood Microsystems is one example of a suitable valve mechanism. This normally closed gas valve operates upon the principle that heating a gas will cause the gas to expand; accordingly, if the gas volume is held constant, the gas pressure will increase as heat is applied. The pressurized gas can then be used to move a diaphragm, allowing it to function as a valve gate for controlling the flow of fluid. The valves are further adapted for hydraulic communication with input port **26** and drain port **28** to create a bidirectional fluid flow between bellows **10** or **10A** and a hydraulic source facility (discussed below) coupled to ports **26** and **28**. In particular, when the device is programmed for positive linear thrust (i.e., during the expansion mode of bellows **10** or **10A**), the valves are adapted to receive hydraulic fluid from the hydraulic source facility through input port **26**, and then direct this fluid into the bellows chamber. Alternatively, during the contraction mode of bellows, the valves are operable to direct hydraulic fluid being discharged from the bellows into the hydraulic source facility through drain port **28**.

As mentioned above and as illustrated in FIG. 4, the input port **26** is coupled to a hydraulic source facility of higher pressure than ambient pressure, indicated by P_1, that provides hydraulic fluid to input port **26**, while the drain port **28** is coupled to a facility of lower pressure than ambient pressure, indicated by P_2, so that it draws hydraulic fluid from drain port **28**. It is noted that the facilities P_1 and P_2 can be pumps connected to the same source of hydraulic fluid indicated at S in FIG. 4. The facilities P_1 and P_2 can be connected to the respective input and drain ports **26** and **28** of each microactuator assembly **8** through respective feed lines L_1 and L_2, each fitted with an array of taps hydraulically coupled to the respective port of a corresponding microactuator assembly **8**. This parallel architecture allows hydraulic fluid to be simultaneously and independently supplied to all, a subset, or a single one of the bellows devices. The hydraulic fluid in line L_1 must be maintained at a sufficient pressure as provided by facility P_1 such that the pressurized hydraulic fluid is constantly presented to all of the input ports **26**. The line L_2 is likewise maintained at a pressure sufficiently below ambient pressure so that any of the bellows of the assemblies **8** can be quickly drained of at least a part of any hydraulic fluid within the bellows through the corresponding drain ports **28**. Finally, a separate processor PR, for example a computer system, is connected to each of the assemblies through a common bus CB. Each assembly is provided with a unique address. The processor PR provides both an address and control signal to each assembly over the bus so that each assembly is separately controlled. Each control signal provides the appropriate information of how much the bellows of a particular assembly should be extended or contracted from its current position. This parallel architecture allows all of the bellows of the assemblies **8** to be simultaneously and independently controlled. This parallel architecture among the actuator assemblies **8** minimizes construction complexity and cost, and is amenable to the addition of further actuator assemblies through their attachment to any available drain and supply taps along the appropriate feed lines and connection to the control bus CB.

In accordance with one alternative aspect of the present invention, each actuator assembly **8** can be designed to have a local intelligence capability that permits it to analyze motion requests from other actuator assemblies and to generate its own commands. In this instance the processor PR would be partially used, or not used to perform the control function for the entire array of actuator assemblies.

As described below in connection with FIG. 5, this local intelligence is embodied in circuit **14** and comprises a very large-scale integrated (VLSI) circuit chip including a receiver demultiplexer (DMUX) **40** for receiving commands addressed to the actuator assembly. Processor **14** further includes microprocessor **42** for analyzing and responding to the commands, preferably in conjunction with a memory unit that furnishes a matrix of appropriate responses. An analog servo control circuit **44** is also provided for controlling the valves, hence regulating the transmission of hydrau-

lic fluid into the bellows. A position sensor 46 operates in a feedback loop with servo system 44 to provide position information to microprocessor 42.

Referring to FIG. 5, a block diagram is shown of the electronic control apparatus embodied in circuit 14 of each actuator assembly. The receiver DMUX 40 receives address and data signals (representative of power or force, or a position of the bellows) from the common bus CB which are applied to the circuit 14 through connector 20 (see FIG. 1). Comparing the address signal and the address of the assembly 8 (which can be stored in the memory of the microprocessor 42), if a match is made the data signal is decoded by DMUX 40 and forwarded to the microprocessor 42.

The microprocessor 42 analyzes the data and determines an appropriate course of action. For example, when the data represents a command to operate bellows 10 in a particular manner (e.g., in a contracted or expanded state), it is necessary to determine whether such an operation falls within the range of valid and permissible actions of the bellows. This determination may be facilitated by a memory unit provided with microprocessor 42, which includes a table of appropriate responses each indexed to a respective command. By accessing the memory upon receiving a command, the microprocessor will formulate a reply in accordance with the response retrieved from memory. This reply may take the form of a denial of the requested operation, or acceptance of the request followed by its execution.

In the event that the bellows is to be activated, either in response to a request from another actuator assembly or in response to a self-directed command provided by the actuator assembly itself, or a signal provided by the processor PR, the current position of the bellows is determined, and compared to the desired position requested by the data signal. Based on this comparison, an appropriate position command is generated to initiate activation of the bellows. The digital position command is converted by a digital-to-analog (D/A) converter 48 into an analog signal representation. This conversion is necessary in the embodiment described because the servo feedback loop and the valves are responsive to analog signals.

The analog position command is applied to an analog servo control circuit 44 that operates a closed-loop feedback function to ensure proper activation of bellows 10. The position command is applied to the positive reference port of a differential summer 50 where it is combined with the feedback signal appearing at the negative reference port. The differential summer 50 provides an error signal ϵ that is amplified by amplifier 52 and then forwarded to the valves as a control signal representative of the degree of flow control that the valves are to exercise over the pressurized fluid. Hence, the control signal reflects the amount of hydraulic fluid to be admitted into or withdrawn from bellows 10 so that the bellows moves to the desired position. Obviously, if the bellows is already in the desired position the control signal will indicate that no change is necessary.

A position sensor 46 continuously monitors and detects the position of a reference point on bellows 10 and provides a position indicator representative of this detected position. The position indicator is scaled by a gain constant of value β using a feedback scaler 54. The scaled signal is applied to the negative reference port of differential summer 50 as the feedback signal. As shown, a feedback path is formed by position sensor 46 and feedback scaler 54. The analog servo control circuit 44 continues to operate until the error signal is optimized, indicating that bellows 10 is now in its desired position.

As described above, when each actuator assembly is equipped with its own microprocessor, a number of operational advantages can be provided. By distributing the computer power of the entire system into individual microprocessors each independently operable and self-administrating, multiple tasks may be run in parallel. This concurrent processing improves the adaptive response of the system and reduces 8 the computation period needed to implement a specified operation since each actuator is only responsible for monitoring its own environment. Conventional systems are characterized by completely relying on remote processing, in which a central computer performs all of the processing for all actuator assemblies. Consequently, the signal paths to the actuator assemblies can be quite lengthy, limiting the communications to low bandwidth signals. As a result, conventional actuators exhibit very slow operating speed, an unacceptable feature especially where fast, precise motions are needed. By contrast, the local processing within each actuator assembly of the present invention eliminates any concern over unduly long communication paths, allowing the transmission of high bandwidth signals to create a faster, more responsive system. The availability of high bandwidth feedback to servo system 44 results in a faster convergence of the bellows movement to its desired position.

The local processing also permits each actuator assembly to receive commands from a number of different locations. This allows construction of a redundant system in which each actuator assembly can function as a system supervisor to monitor the overall system operation and even to assume complete control in the event that a system failure disables the processing capability of all other actuator assemblies.

In accordance with another aspect of the present invention, circuit 14 serves as a common platform to facilitate the monolithic integration of the microactuated valves and the electrical control apparatus. This integration may be established using a single silicon wafer as the platform. Additionally, the entire actuator assembly is preferably configured as an integrated device by packaging circuit 14, connector 20, and the hydraulic fluid ports 26 and 28 onto a single embedded platform represented by controller 12, which is then directly integrated with bellows 10.

As noted above, current robotics technology includes finger elements that structurally emulate the phalangeal articulations comprising the digital extremities of the human hand. However, their operation is severely limited by the absence of a suitable power system capable of duplicating the muscle activity that controls movement of the human fingers. The actuator assembly according to the present invention represents a significant technological advance in delivering precise, high-intensity power at micro-scale dimensions, and therefore may serve as an integral feature of robotics systems, as discussed below.

Several elements of the actuator assembly disclosed herein constitute analogues of certain anatomical features within the human body that are responsible for muscle activity. In particular, the pressurized hydraulic fluid applied to bellows 10 corresponds to an arterial blood flow that provides oxygenated blood to the muscle tissue. Therefore, the fluid being discharged from bellows 10 corresponds to the de-oxygenated venous blood flow leaving the muscle tissue. Additionally, the microcomputer within circuit 14 provides the electrical signals sufficient to activate and control the bellows motion, functioning similarly to the nervous system that supplies the impulse energy needed to excite the cells of the muscle tissue. Accordingly, the integrated actuator assembly of the present invention exhibits

operating characteristics that make it suitable for deployment as a micro-muscle simulator, hence serving as an enabling technology for designing miniature modular muscles useful in robotic applications.

In accordance with a preferred embodiment of the present invention, the actuator assembly disclosed herein is adapted for use as the elemental building block in manufacturing micro-muscle simulators. Specifically, the actuator assembly functions as a suitable power control system for reproducing the muscle activity needed to flex the robotic finger joints. This adaptation is illustrated in FIG. 6, wherein a surgical robot robotically performs laparoscopic examinations on a subject patient indicated at 60. The robot includes a miniature, three-fingered hand 62 whose finger joints are powered by a plurality of microactuator assemblies 8, each of which functions as a micro-muscle simulator. A control glove 64 is worn by the surgeon 68 to control the movement of the robotic fingers. A visualization system (not shown) is preferably used by the surgeon to monitor the surgical field inside the patient.

Based upon an analysis of the maneuvers undertaken by a surgeon to perform endoscopic procedures, a three-fingered robotic hand is believed to be adequate to substantially simulate the functions of the human hand. A repeater device (not shown) is used as an interface between the surgeon and the robotic hand, functioning as a control apparatus that is responsive to input data provided by a surgeon for generating motion commands that activate the robotic hand. The repeater device simply transmits (i.e., repeats) the motion components that are generated by the surgeon, without any intermediate coordinate transformation or motion analysis. In a preferred implementation, the repeater device is configured as an exoskeletal or glove controller 66 that is adapted to receive the hand of a surgeon, who then manipulates the fingers of the glove to effect endoscopic positioning.

Position detectors (not shown) are disposed on the glove to measure the orientation of each joint of the hand. When it becomes necessary to maneuver the endoscope, the surgeon moves the fingers of the glove controller in the desired fashion. This motion is detected by the position detectors as orientation values, which are encoded by a command signal generator and supplied to the array of actuator assemblies. These control signals are decoded and transferred to the appropriate actuator assemblies to simulate a muscle activity that moves the robotic fingers. The command signals, in particular, control the motion of a corresponding joint in the robotic hand located within the patient's body.

The robotic hand is essentially a miniaturized, scaled-down version of the glove controller, and is mechanically coupled to the endoscopic instrument such that movement of the robotic fingers is directly communicated to the instrument as functionally equivalent displacement vectors. This motion within the robotic fingers is created by an array of micro-muscle simulators (i.e., actuator assemblies) each responsible for the motion of a particular joint. The actuator assemblies are coupled via their linkage mechanisms 22 and 24 (see FIG. 1) to respective articulations of a robotic finger. Upon receiving a motion command (which is carried on the lines in FIG. 5), the actuator assembly will respond and activate the bellows, producing a force component that is communicated to the robotic finger joints. For example, if a bending motion is requested of the forefinger, the appropriate bellows devices will be operated in their contraction modes.

By using such a glove-type controller to drive a geometrically identical but miniaturized robotic hand, the design of the robotic hand need not be constrained by concerns over whether the robotic hand will be issued a series of geometrically illegal motion commands related to inter-finger motion. Even if the robotic hand possesses degrees of freedom in its fingers and joints that do not have counterpart human motions, the use of the surgeon's finger movements as the source of all motion commands to the actuator assemblies means that the glove controller cannot issue a set of commands which violate the finger geometry constraints. Stated otherwise, the anatomical limitations governing the range of movement within the human hand are the same limitations experienced by the robotic hand. If a sequence of switches were used to control each of the finger joints, for example, the process of determining finger interference would be a major calculational task since activation of the switches does not reflect actual human motions.

What has been shown and described herein is a novel apparatus capable of delivering force components at micro-scale dimensions. The apparatus is configured as an actuator device that converts a pressure signal (i.e., a pneumatic or hydraulic fluid flow) into a power signal sufficient to displace objects at this dimensional level. A bellows is provided to perform the actuator function, while an arrangement of programmable micromachined valves is used to regulate the flow of pressurized fluid through the bellows. A microprocessor controls the operation of the apparatus. In a preferred configuration, the elements of the apparatus are assembled onto an integrated platform. The operating features of the apparatus make it well-suited for deployment in a robotics application, functioning as a micro-muscle simulator to provide adequate power for simulating the muscle activity required by the joints of robotic fingers.

Since certain changes may be made in the above apparatus and method without departing from the scope of the invention herein described, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted in an illustrative and not in a limiting sense.

What is claimed is:

1. An integrated apparatus for generating a motion stimulus, said apparatus comprising:

a base;

bellows means, at least partially integrally coupled to said base and responsive to a pressure condition at an input port of said bellows means, for generating a motion stimulus;

valve means, at least partially formed within said base and integrally coupled to said bellows means, for operatively regulating the application of pressure to the input port of said bellows means; and

a controller means, at least partially formed within said base, for controlling the operation of said valve means.

2. The apparatus as recited in claim 1, further comprising pressure generation means for generating said pressure.

3. The apparatus as recited in claim 2, wherein said pressure generation means comprises:

source means for generating a flow of pressurized fluid; and

vacuum means for generating a vacuum pressure.

4. The apparatus as recited in claim 3, wherein said source means generates a pneumatic fluid flow.

5. The apparatus as recited in claim 3, wherein said source means generates a hydraulic fluid flow.

6. The apparatus as recited in claim 3, wherein said valve means comprises:

a first selectively operable micromachined valve adapted to admit the flow of pressurized fluid from said source means into said bellows means; and

a second selectively operable micromachined valve coupled to said vacuum means and adapted to withdraw pressure from said bellows means.

7. The apparatus as recited in claim 3 wherein said valve means comprises a micromachined valve adapted to be selectively coupled to said source means for admitting the flow of pressurized fluid from said source means into said bellows means, or coupled to said vacuum means for withdrawing pressurized fluid from said bellows means.

8. The apparatus as recited in claim 3, further comprising:

a fluid supply port for coupling said source means to said valve means; and

a fluid drain port for coupling said vacuum means to said valve means.

9. The apparatus as recited in claim 1, further comprising connector means for providing data signals and power signals to said controller means, wherein said data signals are representative of a desired movement of said bellows means.

10. The apparatus as recited in claim 1, wherein said controller means comprises a microcomputer.

11. The apparatus as recited in claim 10, further comprising:

detection means, in motion-detecting relationship with said bellows means, for detecting a position of said bellows means; and

feedback means, responsive to the detected position of said bellows means and a position command signal from said microcomputer that is representative of a selected position of said bellows means, for adjusting the operation of said valve means.

12. The apparatus as recited in claim 1, wherein said bellows means is configured to generate a substantially linear thrust.

13. The apparatus as recited in claim 1, wherein said bellows means is configured to generate a substantially non-linear thrust.

14. The apparatus as recited in claim 13, wherein said substantially non-linear thrust includes a rotational motion component.

15. A robotic system comprising:

at least one robotic movable member; and

an integrated actuator assembly coupled to said robotic movable member for moving said robotic movable member, said integrated actuator assembly comprising:

a base,

bellows means for generating a motion stimulus as pressurized fluid flows through an input port thereof,

valve means, at least partially formed within said base in fluid communication with the input port of said bellows means, for controllably regulating the fluid flow through the input port of said bellows means, and

controller means, at least partially formed within said base and coupled to said valve means, for controlling the operation of said valve means.

16. The robotic system as recited in claim 15, wherein said bellows means is operable in an expansion mode to create thrust in a first direction to move said robotic movable member as pressurized fluid is admitted into said bellows means, and operable in a compression mode to create thrust in a second direction opposite to said first direction to move said robotic movable member as pressurized fluid is withdrawn from said bellows means.

17. The robotic system as recited in claim 15, wherein said bellows means is configured to generate a substantially linear motion stimulus to move said robotic movable member.

18. The robotic system as recited in claim 15, wherein said bellows means is configured to generate a substantially curvilinear motion stimulus to move said robotic movable member.

19. The robotic system as recited in claim 15, further comprising:

fluid supply means, coupled to said valve means, for supplying a flow of pressurized fluid to said valve means; and

fluid reservoir means, coupled to said valve means and maintained at a pressure sufficient to withdraw fluid from said bellows means and then through said valve means, for receiving fluid withdrawn from said bellows means.

20. The robotic system as recited in claim 15, wherein said valve means comprises a configuration of programmable micromachined valves.

21. The robotic system as recited in claim 15, wherein said controller means comprises a microprocessor.

22. The robotic system as recited in claim 21, wherein the integrated actuator assembly further comprises:

connector means adapted to receive data signals indicating a requested operating state of said bellows means, and to receive power signals; and

receiver means, coupled to said connector means, for distributing said power signals as required by electrical requirements of said actuator assembly, and forwarding said data signals to said microprocessor.

23. The robotic system as recited in claim 22, wherein said microprocessor is responsive to said data signals for generating a command signal that effects the appropriate operation of said valve means consistent with the requested operating state of said bellows means.

24. The robotic system as recited in claim 23, wherein the integrated actuator assembly further comprises memory means, coupled to said microprocessor and including a plurality of position commands each indexed to an operating state of said bellows means, for providing as said command signal the position command corresponding to said requested operating state.

25. The robotic system as recited in claim 21, further comprising:

detection means, in motion-detecting relationship with said bellows means, for detecting a position of said bellows means; and

feedback means, responsive to the detected position of said bellows means and a position command signal from said microprocessor that is representative of a selected motion of said bellows means, for adjusting the operation of said valve means until the position of said bellows means converges to said selected motion.

26. A robotic system comprising:

a plurality of micromanipulative actuator assemblies, each comprising:

a bellow means, responsive to a pressure conditions at an input port and drain port thereof, for generating a motion stimulus;

a valve means, coupled to said bellows means, for operatively regulating the application of a pressure to at least one of the input and drain ports of said bellows means;

a controller means for controlling the operation of said valve means;

a common feed line connecting the input ports of all of said bellows means; and

a common feed line connecting the drain ports of all of said bellows means.

27. In an endoscopic system including a robotic system for maneuvering an implement, said robotic system comprising:

a plurality of micromanipulative actuator assemblies, each comprising:

bellows means, responsive to a pressure conditions at an input port and drain port thereof, for generating a motion stimulus;

valve means, coupled to said bellows means, for operatively regulating the application of a pressure to at least one of the input and drain ports of said bellows means;

controller means for controlling the operation of said valve means;

a common feed line connecting the input ports of all of said bellows means; and

a common feed line connecting the drain ports of all of said bellows means.

28. The apparatus as recited in claim 1, wherein the base comprises silicon.

29. The robotic system as recited in claim 15, wherein the base comprises silicon.

30. The robotic system as recited in claim 15, wherein the robotic movable member is a phalanx of a robotic finger.

31. The robotic system as recited in claim 30, wherein the integrated actuator assembly is located within the robotic finger.

32. A robotic finger comprising:

at least one joint at which two pivotable finger members are pivotably connected; and

an integrated actuator assembly within the robotic finger coupled to one of the pivotable finger members to pivot the pivotable finger members relative to each other, said integrated actuator assembly comprising:

a base;

bellows means, at least partially integrally coupled to said base and responsive to a pressure condition at an input port of said bellows means, for generating a motion stimulus;

valve means, at least partially formed within said base and integrally coupled to said bellows means, for operatively regulating the application of pressure to the input port of said bellows means; and

electronic controller means, at least partially formed within said base, for controlling the operation of said valve means.

33. An integrated apparatus for generating a motion stimulus, said apparatus comprising:

bellows means, responsive to a pressure condition at an input port thereof, for generating a motion stimulus;

pressure generation means for generating pressure at said input port, said pressure generation means comprising source means for generating a flow of pressurized fluid and vacuum means for generating a vacuum pressure;

valve means, integrally coupled to said bellows means, for operatively regulating the application of said pressure at the input port of said bellows means, said valve means comprising:

a first selectively operable micromachined valve adapted to admit the flow of pressurized fluid from said source means into said bellows means, and

a second selectively operable micromachined valve coupled to said vacuum means and adapted to withdraw pressure from said bellows means; and

integral controller means for controlling the operation of said valve means.

34. An integrated apparatus for generating a motion stimulus, said apparatus comprising:

bellows means, responsive to a pressure condition at an input port thereof, for generating a motion stimulus;

pressure generation means for generating pressure at said input port, said pressure generation means comprising source means for generating a flow of pressurized fluid and vacuum means for generating a vacuum pressure;

valve means, integrally coupled to said bellows means, for operatively regulating the application of said pressure at the input port of said bellows means, said valve means comprising a micromachined valve adapted to be selectively coupled to said source means for admitting the flow of pressurized fluid from said source means into said bellows means, or coupled to said vacuum means for withdrawing pressurized fluid from said bellows means; and

integral controller means for controlling the operation of said valve means.

35. In a robotic system including a configuration of robotic fingers, an integrated actuator assembly coupled to said robotic fingers for displacing said robotic fingers, said assembly comprising:

bellows means for generating a motion stimulus as pressurized fluid flows through an input port thereof;

valve means, in fluid communication with the input port of said bellows means, for controllably regulating the fluid flow through the input port of said bellows means, said valve means comprising a configuration of programmable micromachined valves; and

controller means, coupled to said valve means, for controlling the operation of said valve means.

36. In a robotic system including a configuration of robotic fingers, an integrated actuator assembly coupled to said robotic fingers for displacing said robotic fingers, said assembly comprising:

bellows means for generating a motion stimulus as pressurized fluid flows through an input port thereof;

valve means, in fluid communication with the input port of said bellows means, for controllably regulating the fluid flow through the input port of said bellows means;

controller means, coupled to said valve means, for controlling the operation of said valve means, said controller means comprising a microprocessor;

connector means adapted to receive data signals indicating a requested operating state of said bellows means and to receive power signals;

receiver means, coupled to said connector means, for distributing said power signals as required by electrical requirements of said actuator assembly, and forwarding said data signals to said microprocessor, said microprocessor being responsive to said data signals for generating a command signal that effects the appropriate operation of said valve means consistent with the requested operating state of said bellows means; and

memory means, coupled to said microprocessor and including a plurality of position commands each indexed to an operating state of said bellows means, for providing as said command signal the position command corresponding to said requested operating state.

* * * * *

CERTIFICATE OF CORRECTION

PATENT NO.: **5,697,285**

DATED: **December 16, 1997**

INVENTOR(S): Bruce Nappi et al.

It is certified that errors in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 1, column 14, line 50, delete "a" and substitute therefor -- electronic --;

Claim 26, column 16, line 55, delete "a bellow" and substitute therefor -- bellows --;
line 58, delete "a"; and
line 62, delete "a".

Signed and Sealed this

Thirty-first Day of March, 1998

Attest:

Bruce Lehman

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

US005816639A

United States Patent [19]

DiBiagio et al.

[11] **Patent Number: 5,816,639**

[45] **Date of Patent: Oct. 6, 1998**

[54] **FLEXIBLE PLUMBING ASSEMBLY**

[75] Inventors: **Anthony J. DiBiagio**, Granger, Ind.; **Gordon G. Hastings**, Columbus, Ohio; **Todd C. Krenelka**, Dublin, Ohio; **Thomas J. Ward**, Hilliard, Ohio

[73] Assignee: **Monaco Coach Corporation**, Wakarusa, Ind.

[21] Appl. No.: **821,905**

[22] Filed: **Mar. 21, 1997**

Related U.S. Application Data

[63] Continuation of Ser. No. 520,166, Aug. 25, 1995, Pat. No. 5,658,031.

[51] **Int. Cl.**[6] **B06R 27/00**

[52] **U.S. Cl.** **296/26.13**; 296/156

[58] **Field of Search** 296/26, 156

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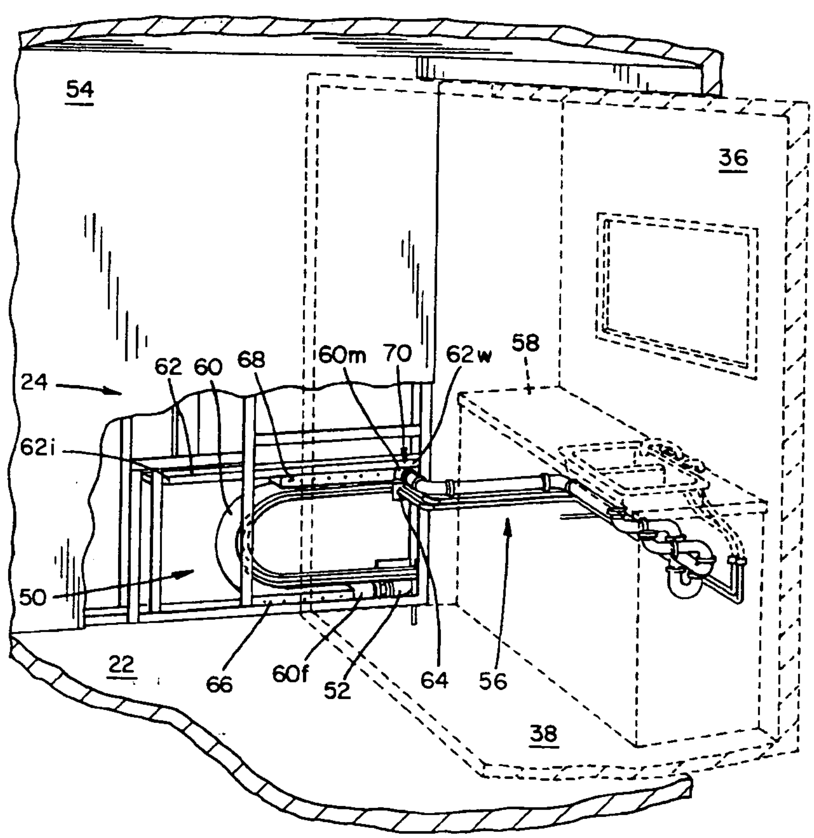
Primary Examiner—Joseph D. Pape

Attorney, Agent, or Firm—Leydig, Voit & Mayer, Ltd.

[57] **ABSTRACT**

A flexible plumbing assembly is provided for use in a trailer with an extensible cabin having rigid plumbing that can be moved between a retracted position wherein the extensible cabin is substantially inside the trailer and an extended position wherein the extensible cabin is substantially outside the trailer. The flexible plumbing assembly comprises a flexible hose connecting the trailer rigid plumbing to the cabin rigid plumbing, a sliding guide for horizontally moving the connection of the flexible hose to the cabin rigid plumbing at a constant elevation relative to the cabin floor as the cabin rigid plumbing moves with the cabin between the extended and retracted positions, and a hose guide for ensuring that material in the flexible hose moves in the proper direction as the cabin moves between the extended and retracted positions. In the preferred embodiment, the sliding guide comprises a support bracket which hold the connection of the flexible hose to the cabin rigid plumbing and is slidably attached to a track that is generally parallel to both the floor and the front and rear walls of the cabin.

12 Claims, 3 Drawing Sheets



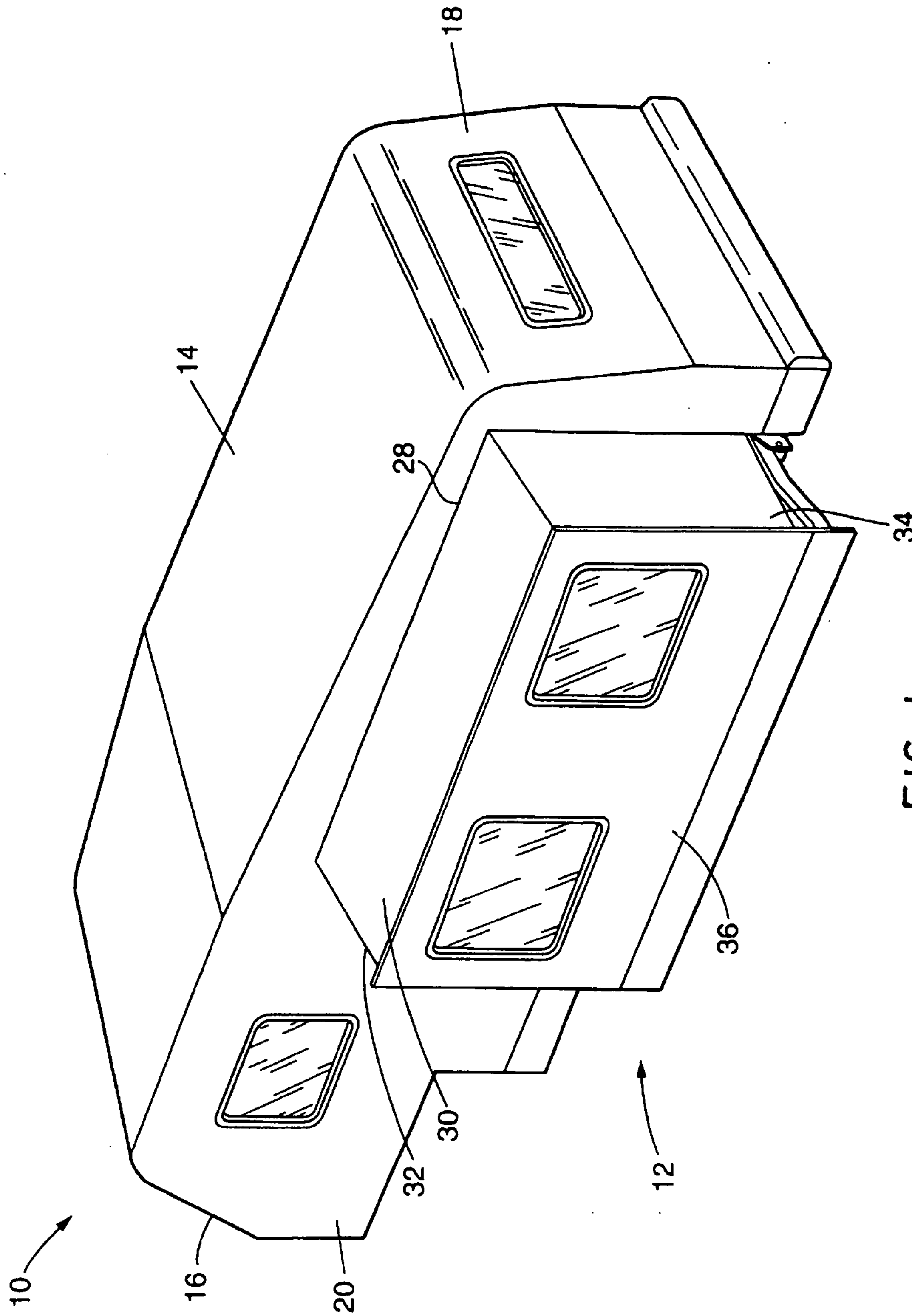


FIG. 1

FIG. 2

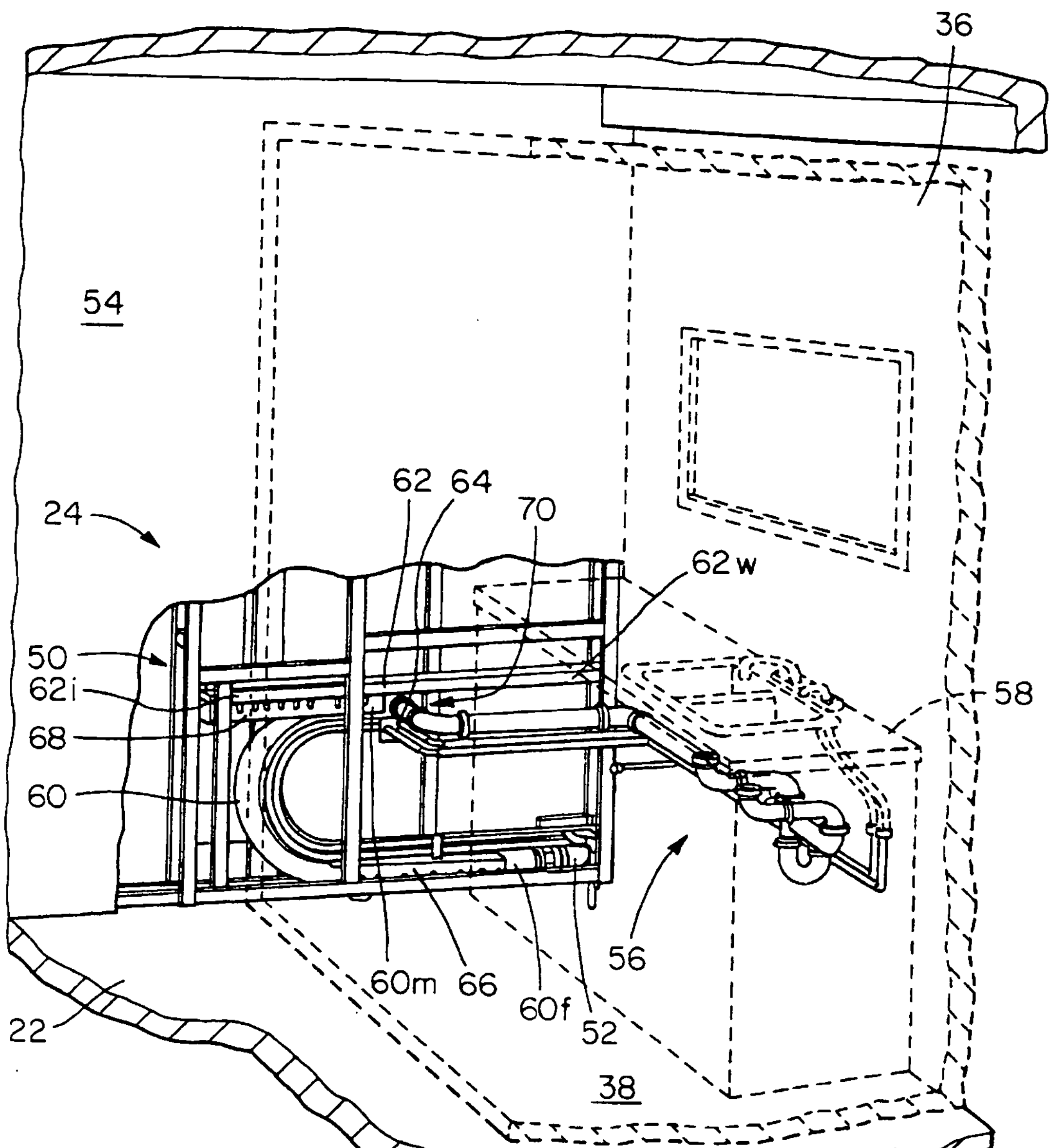
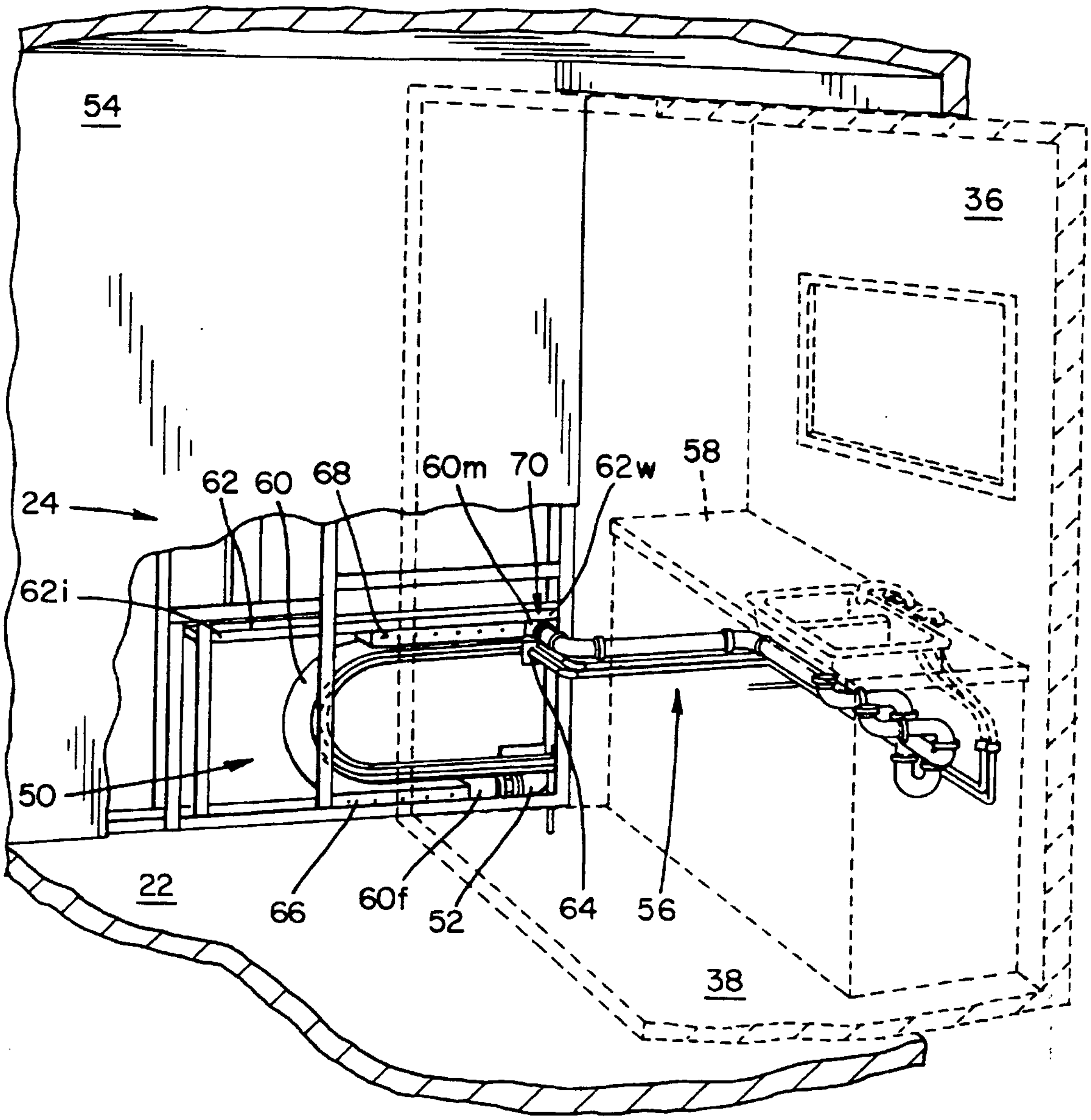


FIG. 3



FLEXIBLE PLUMBING ASSEMBLY

This is a continuation of application(s) Ser. No. 08/520,166, filed Aug. 25, 1995; now U.S. Pat. No. 5,658,031.

FIELD OF THE INVENTION

This invention generally relates to flexible plumbing assemblies and, more particularly, to flexible plumbing assemblies for use in travel trailers, fifth wheel trailers, motor homes, recreational vehicles and the like provided with extensible room portions for increasing the living space in the trailer.

BACKGROUND OF THE INVENTION

Many travel trailers have a central or main room containing an extensible cabin portion which is laterally extendable in order to increase the interior space of the trailer when the trailer is parked at its final destination. The extensible cabin portion is typically slidably supported upon the floor of the main room for movement between a stored, retracted position and an extended position.

Typically, the kitchen and bathroom areas had to be located in the central room which does not move, in order to accommodate the rigid plumbing necessary for waste disposal lines, water lines, and gas lines. Therefore, generally only the living room section could be extended out from the central room. Unfortunately, separating the kitchen/bathroom from the extensible room prevents the usable area in the central cabin area from being maximized.

Attempts to locate the kitchen and bathroom areas in the extensible cabin portion have been relatively unsuccessful. One solution to locating the kitchen and bathroom areas in the extensible cabin portion is to provide for connection to the utility lines by quick release connectors. The use of quick release connectors, however, necessitates manually connecting and disconnecting the utility lines each time the extensible cabin portion is moved into the extended position. This can lead to an increased likelihood of a poor connection causing leakage. Further, this leakage could lead to safety problems.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the invention to provide a vehicle, such as a mobile home, house trailer, recreational vehicle, or the like having a laterally extensible cabin with kitchen and/or bathroom areas that does not require manual connection of plumbing.

It is an object of the invention to provide a flexible plumbing assembly permitting the extensible cabin portion of a trailer, mobile home, recreational vehicle or the like to contain areas needing rigid plumbing such as kitchen and bathroom areas thereby increasing the usable interior space of the main room of the trailer.

It is an object of the invention to provide a flexible plumbing assembly which allows the rigid plumbing in the extensible cabin portion to be used in both the extended and retracted positions.

It is a related object to provide a flexible plumbing assembly that does not require manual disconnection of the rigid plumbing in the trailer from the rigid plumbing in the extensible cabin portion when the cabin is moved from the retracted to the extended positions.

It is a related object to provide a flexible plumbing assembly which allows the rigid plumbing in the extensible cabin to be used when the trailer is moving.

Another object of the present invention is to provide a flexible plumbing assembly that maintains a proper drain slope as the extensible cabin moves between the extended and retracted positions.

These and other features and advantages of the invention will be more readily apparent upon reading the following description of a preferred exemplified embodiment of the invention and upon reference to the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a fifth wheel trailer with an extensible cabin in the extended position;

FIG. **2** is a perspective cut away view showing the flexible plumbing assembly disposed within the panel wall in the central room of the trailer and the extensible cabin (in broken lines) in the retracted position;

FIG. **3** is perspective cut away view showing the flexible plumbing assembly disposed within the panel wall in the central room of the trailer and the extensible cabin (in broken lines) in the extended position.

While the invention will be described and disclosed in connection with certain preferred embodiments and procedures, it is not intended to limit the invention to those specific embodiments. Rather it is intended to cover all such alternative embodiments and modifications as fall within the spirit and scope of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and particularly to FIGS. **1–3** the trailer **10** has an extensible cabin or room **12** and a slideout mechanism (not shown), and a flexible plumbing assembly **50**. Although the illustrated trailer is of the "fifth wheel" type which is adapted to be towed by a vehicle (not shown) disposed at the front end, it will be appreciated that the invention is applicable to any type of expandable vehicle or trailer.

The trailer **10** generally has a ceiling **14**, a front wall **16**, a rear wall **18**, two opposing side walls **20** (only the left wall is shown), and a floor **22** which generally define an interior living space or central room **24**. In the illustrated embodiment, the left side wall **20** has an opening **28** for receiving the extensible cabin **12**. The extensible cabin **12** has a cabin ceiling **30**, a front wall **32**, a rear wall **34**, side wall **36**, and a floor **38**.

The extensible cabin **12** is movable between an extended position generally shown in FIG. **1** and in broken lines in FIG. **3** and a retracted position generally shown in broken lines in FIG. **2**. In the extended position, the extensible cabin **12** is extended outwardly from the interior trailer space **24** which increases the overall space available inside the trailer **10**. In the retracted position, the cabin **12** is positioned inwardly into the interior space **24** of the trailer **10** which decreases the exterior dimensions of the trailer **10** for towing and transport over the highways. The trailer **10** has a slideout mechanism (not shown) for positioning the cabin **12** between the retracted and extended positions. U.S. patent application Ser. No. 08/311,945 dated Sept. 26, 1994, which is incorporated by reference, describes several different slideout mechanisms.

The trailer **10** has a flexible plumbing assembly **50** for maintaining the connection between rigid plumbing in the interior space **24** of the trailer and rigid plumbing in the extensible cabin **12** as the extensible cabin moves between

the extended and retracted positions, in accordance with the present invention. The trailer plumbing system may include water or propane supply tanks or storage tanks for waste water and other waste material disposed in the interior space **24** of the trailer. In addition, the plumbing system may include hot and cold water supply lines and drain lines for sinks and a shower, propane supply lines for a gas stove, or drain lines for waste material from a toilet all located in the extensible cabin **12**.

As best shown in FIG. **2**, the trailer **10** has a plumbing system with rigid plumbing located in both the interior space **24** of the trailer **10** and in the extensible cabin **12** (in broken lines). The interior plumbing **52** is disposed within a panel wall **54** located in the interior space **24** of the trailer **10**. The extensible cabin plumbing **56** is contained within a cabinet **58** located along the side wall **36** of the extensible cabin **12**. The flexible plumbing assembly **50** connects the interior plumbing **52** to the extensible cabin plumbing **56** enabling material such as water, waste, or gas to be transported several feet horizontally between the interior space and the extensible cabin when the extensible cabin is in the extended position. Although the illustrated extensible cabin plumbing means is a sink with a double wash basin and a gas line for a stove (not shown) along the side wall **36** of the extensible cabin **12**, it will be appreciated that the invention is applicable to any type of rigid plumbing that is located within the extensible cabin **12**.

The flexible plumbing assembly **50** may comprise a flexible hose, means for horizontally sliding the connection of the flexible hose to the cabin plumbing at the same elevation relative to the floor of the extensible cabin as the extensible cabin moves between the extended and retracted positions, and means for guiding the flexible hose so that the flexible hose maintains a slope sufficient to allow for waste to drain in the proper direction as the extensible cabin moves between the extended and retracted positions.

The flexible hose **60** has a fixed end **60*f*** and a movable end **60*m*** as shown in FIG. **2**. In the illustrated embodiment, the fixed end **60*f*** of the flexible hose **60** is attached to the rigid interior plumbing **52**. The movable end **60*m*** of the flexible hose **60** is attached to the extensible cabin rigid plumbing **56**. The flexible hose **60** is comprised of a flexible material that can bend to accommodate the movement of the extensible cabin **12** between the retracted and extended positions. The flexible hose may be made from any flexible material which will be known to those skilled in the art including, but not limited to, PVC. Further, those skilled in the art will appreciate that the diameter of the flexible hose is dependent upon the size of the trailer and the type of interior plumbing and extensible cabin plumbing the flexible hose is being used to connect. The flexible hose can have a diameter that ranges anywhere from ¼ inch to 6 inches. In addition, the flexible hose **60** must be of length sufficient to reach the extensible cabin rigid plumbing **56** when the extensible cabin **12** is in the extended position. It will be appreciated that the flexible hose **60** can be used to connect rigid propane, hot and cold water supply, drainage, and sewage plumbing in the interior space **24** to like plumbing in the extensible cabin **12**.

The sliding means comprises a track **62** and a support bracket **64**, as depicted in FIG. **2**. As illustrated the track **62** and the support bracket **64** are disposed in the hollow interior of the panel wall **54** that is positioned in the interior space **24** so that it is generally parallel to the extensible cabin **12** front wall **32** and rear wall **34**. Further, the track **62** is disposed so that it runs generally parallel to both extensible cabin floor **38** and the front and rear walls **32** and **34** of the extensible cabin **12**. For ease of reference, the track **62** has an interior end referenced as **62*i*** and an outboard or wall end referenced as **62*w***, as shown in FIGS. **2** and **3**. The track **62** is adapted to receive the support bracket **64**.

The support bracket **64** is adapted to receive and support the connection **70** between the flexible hose movable end **60*m*** and the extensible cabin rigid plumbing **56**. In order to accommodate the horizontal movement of the extensible cabin rigid plumbing **56** relative to the interior space rigid plumbing **52**, the support bracket **64** is slidably connected to the underside of the track **62**. The support bracket **64** is disposed at the track interior end **62*i*** when the extensible cabin **12** is in the retracted position, as shown in FIG. **2**. As the extensible cabin **12** is moved towards the extended position, the support bracket **64** travels horizontally along the track **62** towards the outboard or wall end **62*w*** of the track in unison with the extensible cabin **12**. In addition, the support bracket **64** is maintained at a constant level above the extensible cabin floor **38** in order to accommodate the fixed elevation of the extensible cabin rigid plumbing **56** relative to the extensible cabin floor **38**. Thus, when the extensible cabin **12** is in the fully extended position, the support bracket **64** is at the outboard or wall end **62*w*** of the track and the flexible hose **60** has bent to accommodate the movement from the retracted to the extended positions, as shown in FIG. **3**. In this manner the connection between the movable end of the flexible hose **60*m*** and the extensible cabin plumbing **56** moves along both in unison with the extensible cabin **12** and at a constant level above the extensible cabin floor **38** as the extensible cabin **12** causes the extensible cabin plumbing **56** to move horizontally between the extended and retracted positions.

The flexible hose guiding means comprises a fixed hose guide **66** and a movable hose guide **68**. The fixed hose guide **66** is disposed along the bottom of the panel wall **54** where the flexible hose runs generally parallel to the trailer floor **22**. The movable hose guide **68** is disposed on the underside of the track **62** where the flexible hose also runs generally parallel to the trailer floor **22**. Further, the movable hose guide **68** is both rigidly attached to the support bracket **64** and slidably attached to the track **62**. Thus, as the extensible cabin **12** moves between the retracted and extended positions, the movable hose guide **68** moves in unison with the support bracket **64** towards the outboard or wall end **62*w*** of the track. In order to ensure that material in the flexible hose drains in the proper direction in the areas where it tends to run horizontally, the hose guiding means can be adjusted to provide any predetermined slope in the flexible hose that is necessary to insure proper drainage or to meet any applicable regulations. In the preferred embodiment, both the fixed hose guide **66** and the movable hose guide **68** are adapted to hold the flexible hose **60** so that a one quarter inch per foot slope is maintained in the areas where the flexible hose tends to run horizontally.

Thus, it will be seen that a novel and improved flexible plumbing assembly for use in slideout trailers has been provided which attains the aforementioned objects. Various additional modifications of the embodiment specifically illustrated and described herein will be apparent to those skilled in the art, particularly in light of the teachings of this invention.

We claim as our invention:

1. A flexible plumbing assembly for use in a recreational vehicle having a fixed cabin with a fixed rigid plumbing means, and an extensible cabin that is moveable between a retracted position and an extended position relative to the fixed cabin, the extensible cabin having a movable rigid plumbing means, said flexible plumbing assembly comprising:

a flexible hose having a fixed end connected to the fixed rigid plumbing means and an opposite movable end connected to the movable rigid plumbing means; and

sliding means for moving the movable end at a constant elevation relative to the fixed end as the extensible cabin rigid plumbing moves with the extensible cabin between the extended and retracted positions.

2. The flexible plumbing assembly as set forth in claim 1 wherein said sliding means includes a support bracket secured to move with said extensible cabin and a track secured to said fixed cabin, wherein the support bracket holds said moveable end of said flexible hose and is slidably attached to the track.

3. The flexible plumbing assembly as set forth in claim 2 wherein said track is disposed generally horizontally.

4. The flexible plumbing assembly as set forth in claim 1, further comprising hose guiding means holding at least a portion of the flexible hose at a desired drainage angle as the extensible cabin moves between the extended and retracted positions.

5. The flexible plumbing assembly as set forth in claim 4 wherein said hose guiding means includes a fixed hose guide channel disposed near said fixed end of the flexible hose, and a movable hose guide channel secured to move with said support bracket near said movable end of said flexible hose, wherein portions of the hose lie respectively in the fixed hose guide channel and the movable hose guide channel at desired drain angles.

6. The flexible plumbing assembly as set forth in claim 5, wherein said guide channels hold said hose in a generally U-shaped bend between said guide channels.

7. The flexible plumbing assembly as set forth in claim 1, wherein said flexible hose connects rigid drain plumbing in said extensible cabin to rigid drain plumbing in said fixed cabin.

8. The flexible plumbing assembly as set forth in claim 1, wherein said flexible hose connects rigid propane plumbing in said extensible cabin to rigid propane plumbing in said fixed central cabin.

9. The flexible plumbing assembly as set forth in claim 1, wherein said flexible hose connects rigid sewage plumbing in said extensible cabin to rigid sewage plumbing in said fixed cabin.

10. The flexible plumbing assembly as set forth in claim 1, wherein said flexible hose connects rigid hot and cold water supply plumbing in said extensible cabin to rigid hot and cold water supply plumbing in said fixed cabin.

11. A plumbing assembly for use in a recreational vehicle having a fixed cabin and an extensible cabin which is movably mounted to the fixed cabin, the fixed cabin including fixed rigid plumbing mounted thereto and the extensible cabin including movable rigid puming mounted thereto, the plumbing assembly comprising:

a flexible hose having a fixed end connected to the fixed rigid plumbing and a movable end connected to the movable rigid plumbing;

a generally straight fixed guide channel mounted to the fixed cabin and receiving at least a portion of the flexible hose near the first end; and

a generally straight moveable guide channel mounted move with to the extensible cabin and receiving a portion of the flexible hose near the second end, the guide channels being generally facing each other and holding the flexible hose generally in a U-shape.

12. The plumbing assembly according to claim 11, wherein each of the guide channels holds the respective portion of the flexible hose at an angle to promote drainage through flexible hose.

* * * * *

US005823869A

United States Patent [19]

Paturzo

[11] **Patent Number: 5,823,869**

[45] **Date of Patent: Oct. 20, 1998**

[54] **EXTENDABLE AIR NOZZLE FOR USE WITHIN A VEHICLE'S INTERIOR**

[76] Inventor: **Renato Paturzo**, 14200 NE. 171st St., Ste G-208, Woodinville, Wash. 98072

[21] Appl. No.: **916,599**

[22] Filed: **Aug. 22, 1997**

[51] **Int. Cl.**^{6} **B60H 1/34**

[52] **U.S. Cl.** **454/152**; 344/90; 344/97

[58] **Field of Search** 454/143, 152, 454/156; 34/90, 91, 97, 104

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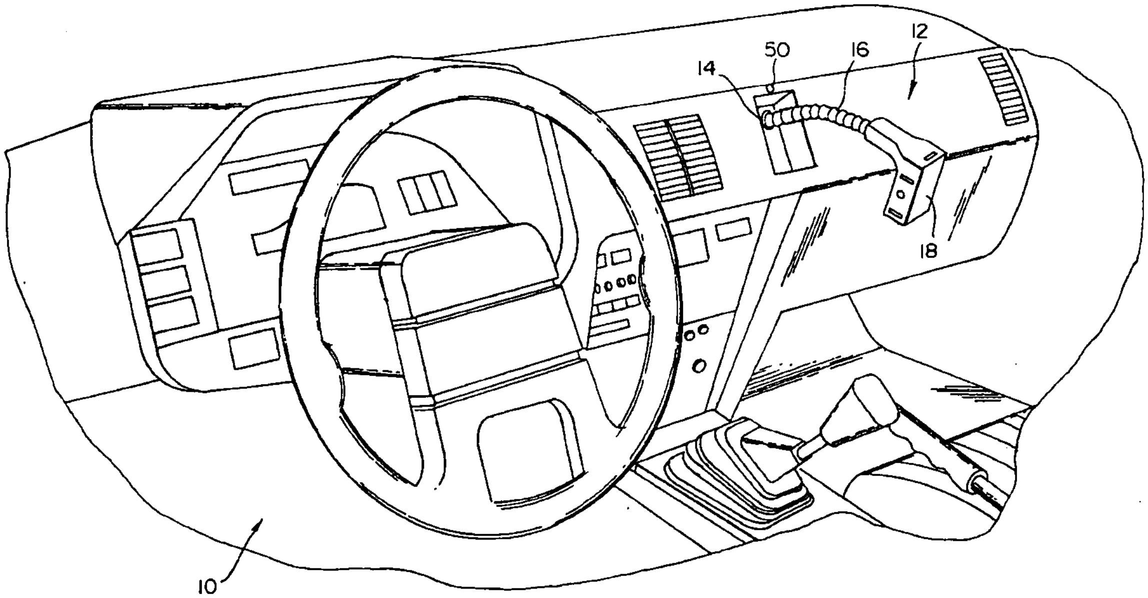
Primary Examiner—Harold Joyce
Attorney, Agent, or Firm—Paul L. Griffiths

[57] **ABSTRACT**

In a vehicle, a self-retracting and extensible air duct in combination with an air distribution system and a nozzle for allowing the use of a treated air-stream at remote locations with a vehicle's interior. Heated air can be used to dry objects such as boots and clothing, or an occupant's hair. Cooled air can be directed directly on an object or in a specific area such as where the sun may be shining in. A connection is made to a vehicle's existing air distribution system with an air duct connecting the system with a receptacle in either the dashboard or the center console. Inside the receptacle is an air conduit storage area and a receiving area where the air conduit and nozzle are stored when not in use. The air conduit is spring loaded in that it will expand from the storage area when the nozzle is released from its receiving area to a natural length and then can be stretched to a greater length for use. The conduit will contract to its natural length to aid in returning it to its stored condition.

7 Claims, 3 Drawing Sheets



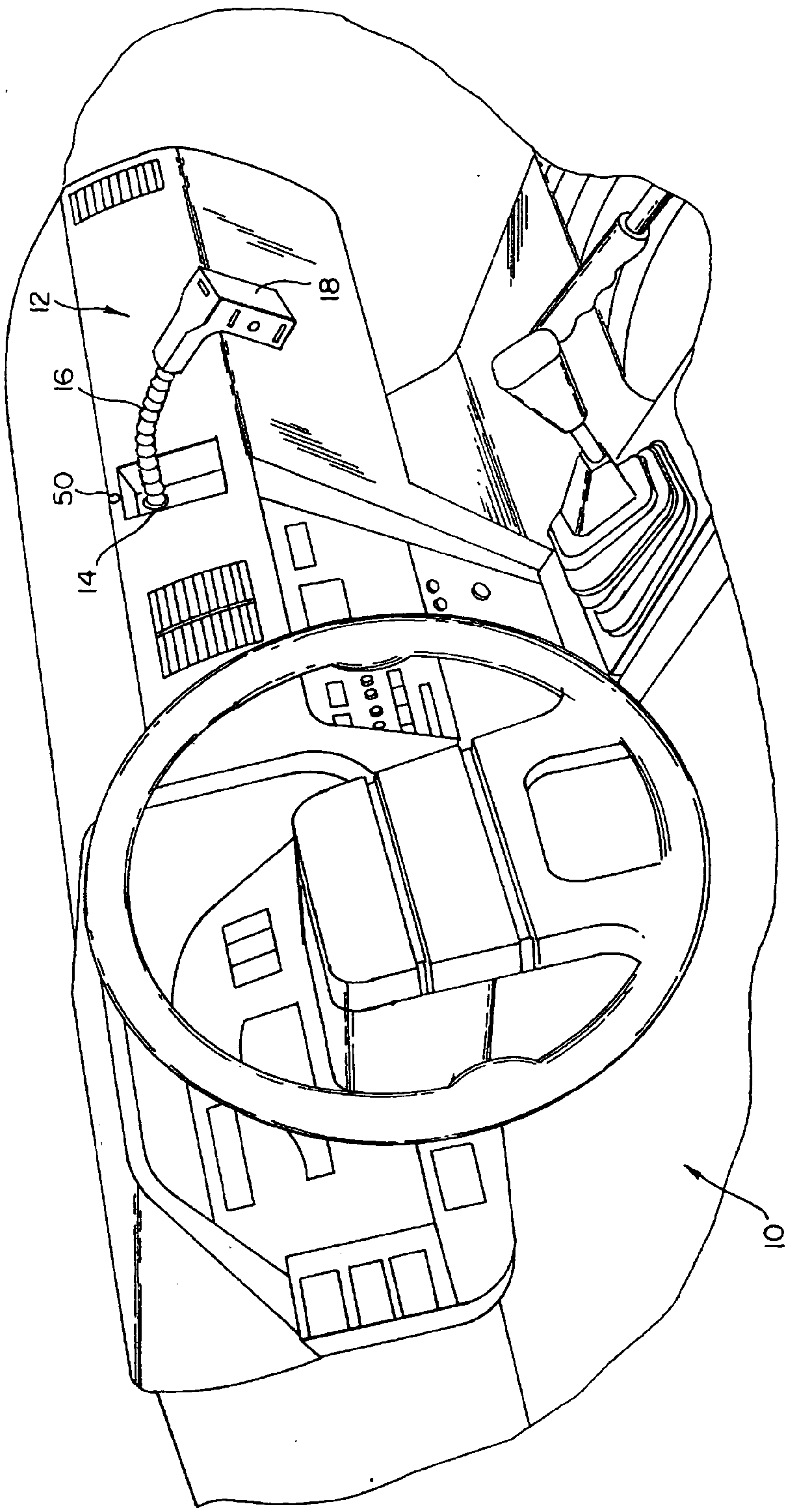


FIG. 1

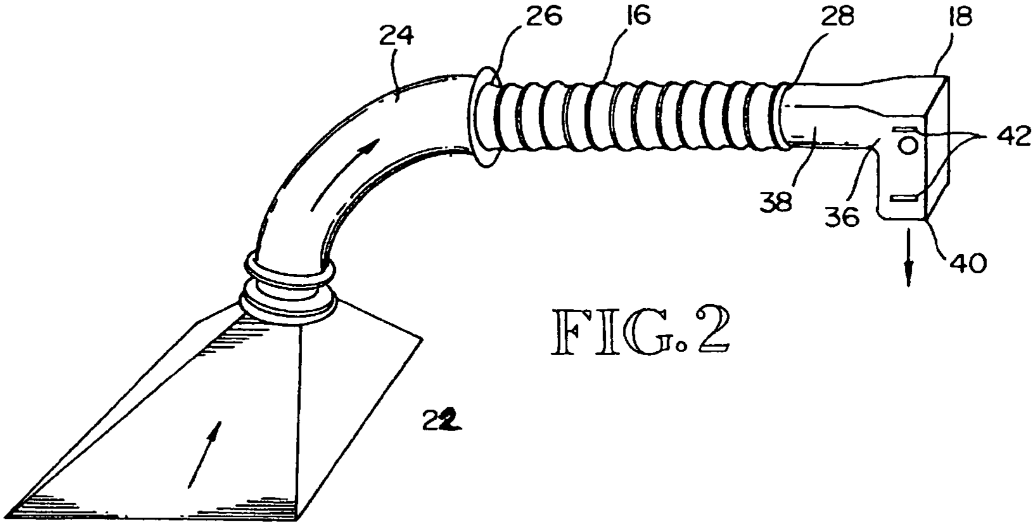


FIG. 2

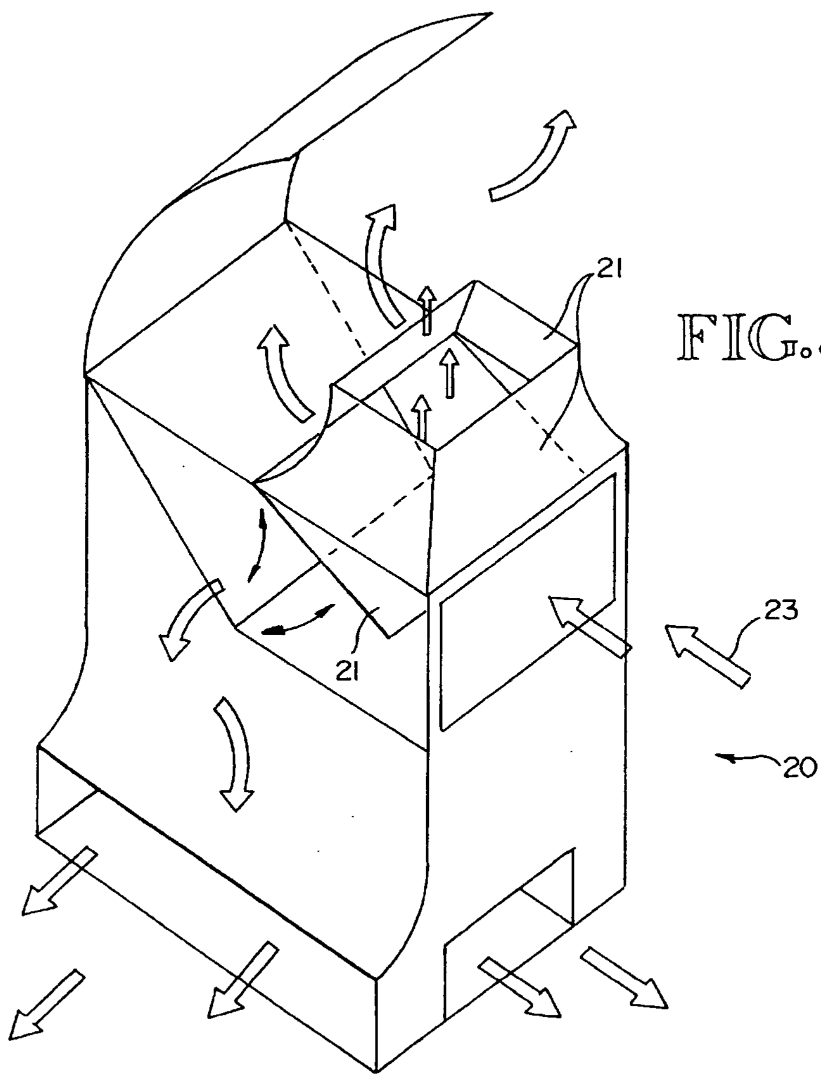


FIG. 3

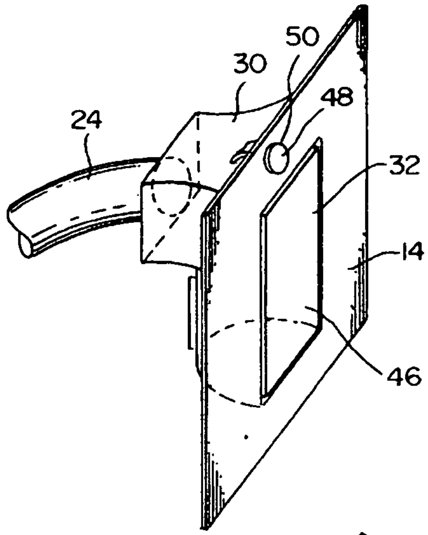


FIG. 4

FIG. 5

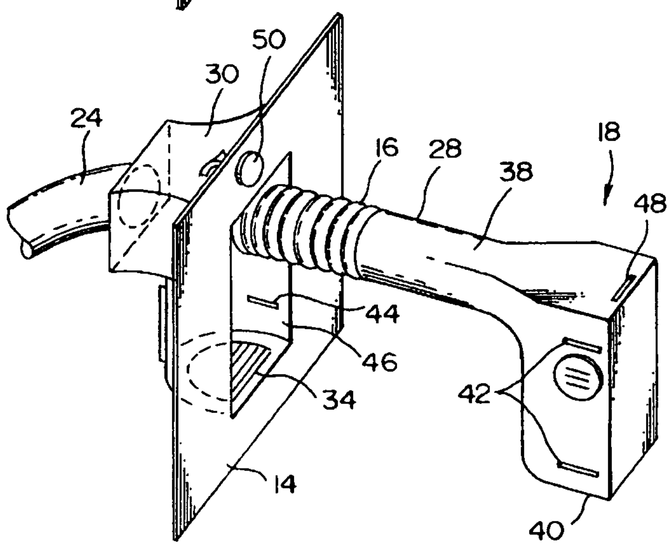
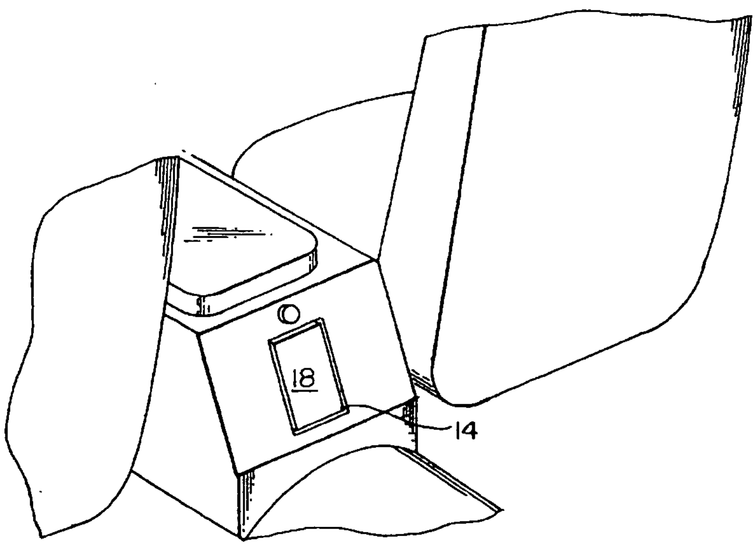


FIG. 6



EXTENDABLE AIR NOZZLE FOR USE WITHIN A VEHICLE'S INTERIOR

TECHNICAL FIELD

The present invention relates to generally to the delivery of a treated air stream within a transportation vehicle and more particularly to the delivery of heated or cooled air to a particular location within a passenger vehicle such as an automobile or truck.

BACKGROUND INFORMATION

Almost every transportation vehicle today, whether it be an automobile, sport utility vehicle, truck, bus, recreation vehicle, etc., has some type of heating system. These systems are generally designed to keep the occupants comfortable. Many vehicles also include apparatus that provides for cooling as well. The systems are generally designed to heat or cool the interior volume of the vehicle. Airstreams are sometimes directed toward specific surfaces within a vehicle, such as the windshield or side windows. The airstream is directed at these surfaces in order to defrost or defog them providing better visibility for the driver.

There are other potential uses of heated or cooled air inside a vehicle. One such use would be to use heated air to dry wet shoes, or boots such as for hiking or skiing. In order to use treated air for these purposes a delivery system is required. One such delivery system is shown in U.S. Pat. No. 3,280,896, issued to Elmer L. Goodson on Oct. 25, 1966. This reference is incorporated herein by reference thereto. The Goodson patent describes other uses of heated or cooled air being supplied by a vehicles heater and air conditioner (if present).

A system such as the one shown and described in the Goodson patent was difficult to use since the flexible hose and various apparatus for use therewith could not be conveniently stored in the passenger compartment of a vehicle. The present invention provides a collapsible, self-retracting hose that is easily stored within the dashboard or center console of a vehicle. The present invention also provides a nozzle fitting on the end of the air conduit hose to aid in use thereof and utilizes a push to release type of latching mechanism to maintain the collapsible hose in a stored position.

SUMMARY OF THE INVENTION

The invention provides a convenient source of low pressure air for use within a vehicle. An air conduit tube is attached by conventional means to a vehicle's air distribution system. The air conduit tube is of a flexible and collapsible type that requires minimal storage space yet can extend for use within the vehicle interior compartment. A nozzle is provided at the end of the air conduit providing a means to grasp the end and incorporated therewith an interlocking, portion that provides a latching action when the air conduit is pushed into its storage area. The latching action further provides for ease of releasing the stored air conduit by pushing on the nozzle, which then is forced out of the storage area by the air conduit's spring action.

Other features, objects and advantages of the invention are hereinafter described in the description of the best mode or preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, like reference characters designate like parts throughout the several views, and:

FIG. 1 is a depiction of a standard dashboard arrangement within a vehicle showing an extensible air conduit and attached nozzle according to one embodiment of the present invention;

FIG. 2 shows a portion of an air collection hood and air conduit according to one embodiment of the present invention;

FIG. 3 is an isometric view of a typical air distribution box of a vehicle showing various air flow options, showing one embodiment of an isolation port;

FIG. 4 is an isometric view showing an air conduit and nozzle receptacle and a portion of a guide and storage tube;

FIG. 5 is a view similar to FIG. 4 showing an air conduit with nozzle in working relationship with a receptacle;

FIG. 6 is a view depicting an alternative embodiment of placement of the present invention within a vehicle.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to the several figures of the drawing and first to FIG. 1, a typical dashboard **10** is shown. An extendible air source **12** is shown partially extended from a receptacle **14** located in said dashboard **10** of a preferred embodiment of the present invention. A self-retracting and flexible air conduit **16** is shown having a nozzle **18** attached to one end thereof. Air conduit **16** is shown in a partially extended condition in FIG. **1**. Air conduit **16** would generally extend four or five feet but could be made to extend further. Receptacle **14** can be placed anywhere on the face of the dash, in the glove box, or in the center console, including a rear location as shown in FIG. **6**.

FIGS. **2** and **3** show possible air paths for treated air. FIG. **3** shows an outline of a typical vehicle air distribution system **20** modified to include an isolation port **21**. System **20** distributes treated air. The treated air may be heated or cooled depending on the environmental conditions present. Typical system **20** usually includes a fresh air (outside air) inlet as well as a recirculation air channel **23**. Air collection hood **22** is adapted to connect in a fluid flow arrangement directly to distribution system **20** or at isolation port **21**. While it is contemplated that extendible air source system **12** will be installed in new vehicles, hood **22** could be modified to attach to an existing distribution system **20** in a retrofit situation where a separate port would be placed in line between the distribution box and a blower assembly (not shown). Air hood **22** feeds treated air into an air duct **24**. Guide and storage tube **24** may be made from rigid tubing or flexible tubing depending on the length and location. Guide and storage tube **24** can connect directly to air conduit **16** or to receptacle **14**. If guide **24** connects to receptacle **14** than air conduit **16** connects to either the very end of guide **24** or to receptacle **14** in fluid flow manner. A first end **26** of air conduit **16** attaches to either guide tube **24** or receptacle **14** in fluid flow manner. A second end **28** of air conduit **16** connects in fluid flow manner to nozzle **18**.

Referring now to FIG. **4**, receptacle **14** will be described. As noted above receptacle **14** may be located in almost any location within a vehicle's interior such as in the dashboard, the center console, or the glove box. Receptacle **14** serves several functions. It includes a storage chamber **30** and a nozzle receiving area **32**. Referring now to FIGS. **4** and **5**, receptacle also includes a louvered area **34**. Louvered area **34** allows air flow to continue even when nozzle **18** is place in a stored condition within its receiving area **32**. This is useful for hand free operation as would be useful in drying gloves or the like.

Nozzle **18** could be of almost any configuration, i.e., straight or bent at any given angle. In the preferred embodiment nozzle **18** includes a ninety-degree elbow **36**. This configuration provides a handle portion **38** and outlet opening **40**. Nozzle **18** includes at least one and preferably 4 indentations **42** or grooves. Indentations **42** interact with bosses **44** on inside surfaces **46** of nozzle receiving area **32**. Bosses **44** and indentations **42** cooperate with each other to orient nozzle **18** vertically within receiving area **32**. A push to release-push to lock mechanism **48** is used to retain nozzle **18** with nozzle receiving area **32**, although any type of latch/release mechanism could be used. Mechanism **48** includes a button **50** which when pushed releases nozzle **18** from within nozzle receiving area **32**. A spring plate ejector **52** located in the back of receiving area **32** must have enough pressure to eject nozzle **18** out of receiver **32** far enough to be grasped and pulled further out. In order to aid in grasping nozzle **18**, finger hold detentions **54** are provided on either side of nozzle **18**.

Air conduit **16** is designed to be both compressible and extensible. It is spring-like in nature in that it has three possible conditions of length. A first condition is in a compressed state such that when it is release it has a tendency to expand to a greater length. A second length which is a natural length which it attains when no outside pressure is exerted on it. And a third length which is variable as it is stretched out, but will recoil when released. Conduit **16** may be made in a variety of ways but it is contemplated herein to have a rubber coil in a spring-like configuration and a highly flexible web or tube wall formed integral with the spring-like portion.

Having described the presently-known best mode for carrying out the invention, and various embodiments thereto, it is to be understood that the extendable air nozzle described above and shown in the drawings could be altered in some ways without departing from what is considered to be the spirit and scope of the invention. For example, it is conceivable, and indeed, it may be likely, that the extendable air source disclosed here will be improved upon in future years. For this reason, any of the foregoing description should not be taken or interpreted in a limiting way, but instead should be used to give life and meaning to the subjoined patent claims which follow. It is the claims which define the metes and bounds of what is considered to be patented, the interpretation of which is to be made in accordance with the established doctrines of patent claim interpretation.

What is claimed is:

1. A extendable air source for use within a vehicle's interior comprising:
   - a vehicle's air distribution system, an attachment means for attaching an air duct to said air distribution system;
   - a spring loaded air conduit having one end connected to said air duct and a second end terminating as a nozzle;
   - a receptacle mounted within said vehicle's interior and including a receiving chamber for receiving said air conduit and a receiving port for receiving said nozzle, and an attachment means for attaching said receptacle to said air duct, a retaining means for retaining said nozzle within said receiving port when not in use, and
   - a retaining mechanism incorporated with the receiving port acting in concert with said nozzle to retain said air conduit in said receiving chamber.

2. An apparatus according to claim **1**, wherein said spring loaded air conduit having a first length in a stored condition, a second length in a partially extended state, and a third length in an in use state, in said first length condition said air conduit is in a compressed state such that when said retaining means is released said air conduit extends to said second length, said second length being said air conduit's natural length in a relaxed state, and said air conduit being, further extensible by pulling on said second end thereof to attain a maximum length in said third length state, and said air conduit then self-retracting from said third length to said second length.

3. An apparatus according to claim **1**, wherein said nozzle includes a ninety-degree elbow, said nozzle further including slight depressions on opposites sides of said nozzle to facilitate the removal of said nozzle and extension of said air conduit from said receptacle.

4. An apparatus according to claim **3**, wherein said nozzle includes a plurality of grooves on side portions thereof for use in aligning said nozzle in said receptacle, said receptacle having a plurality of bosses that interact with said grooves to hold said nozzle in place with said receptacle.

5. An apparatus according to claim **1**, wherein said receptacle includes a louvered bottom portion in fluid flow relationship with said nozzle.

6. An apparatus according to claim **1**, wherein said receptacle is located in said vehicle's dashboard.

7. An apparatus according to claim **1**, wherein said receptacle is located in said vehicle's center console.

* * * * *

US005904183A

United States Patent [19]

Leech

[11] **Patent Number: 5,904,183**

[45] **Date of Patent: May 18, 1999**

[54] **RECREATIONAL VEHICLE WASTE DRAINER**

[76] Inventor: **Alan R. Leech**, 35536 Cypress Haven Way, Leesburg, Fla. 34788

[21] Appl. No.: **08/731,510**

[22] Filed: **Oct. 15, 1996**

[51] **Int. Cl.**^{6} **F16L 57/00**

[52] **U.S. Cl.** **138/110**; 138/114; 138/120; 138/89; 137/355.16

[58] **Field of Search** 138/103, 106, 138/110, 114, 118, 120, 91, 89; 137/355.16; 16/115

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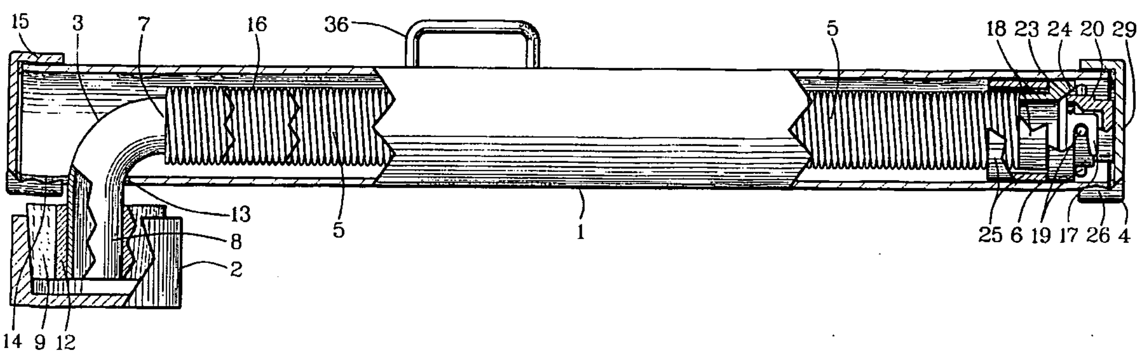
Primary Examiner—Denise L. Ferensic
Assistant Examiner—James F. Hook
Attorney, Agent, or Firm—Edward M. Livingston, Esq.

[57] **ABSTRACT**

A recreational vehicle (RV) waste drainer having a drainer sheath **(1)** with an angled drain nipple **(3)** at a receptacle end in fluid communication with an expandable tube **(5)** in the drainer sheath. A drain end of the expandable tube is attached to the drain nipple. A holding-tank connector **(6)** on a holding-tank end of the expandable tube connects the expandable tube to an RV holding tank **(21, 22)** for draining it and connects the expandable tube to a sheath lid **(4)** for sealing the drainer sheath and the expandable tube against escape of odorous gases and liquid at a tube end of the drainer sheath when not in use. The drain nipple has a beveled nipple-attachment wall **(9)** that is resilient and sized to fit inside of receptacle pipes **(10)** of RV sewage receptacles **(11)**. A nipple lid **(2)** has a nipple sleeve that fits onto the beveled outside periphery of the drain nipple like an input pipe to seal the drainer sheath against escape of odorous gases and liquid at the drain nipple when not in use.

23 Claims, 2 Drawing Sheets



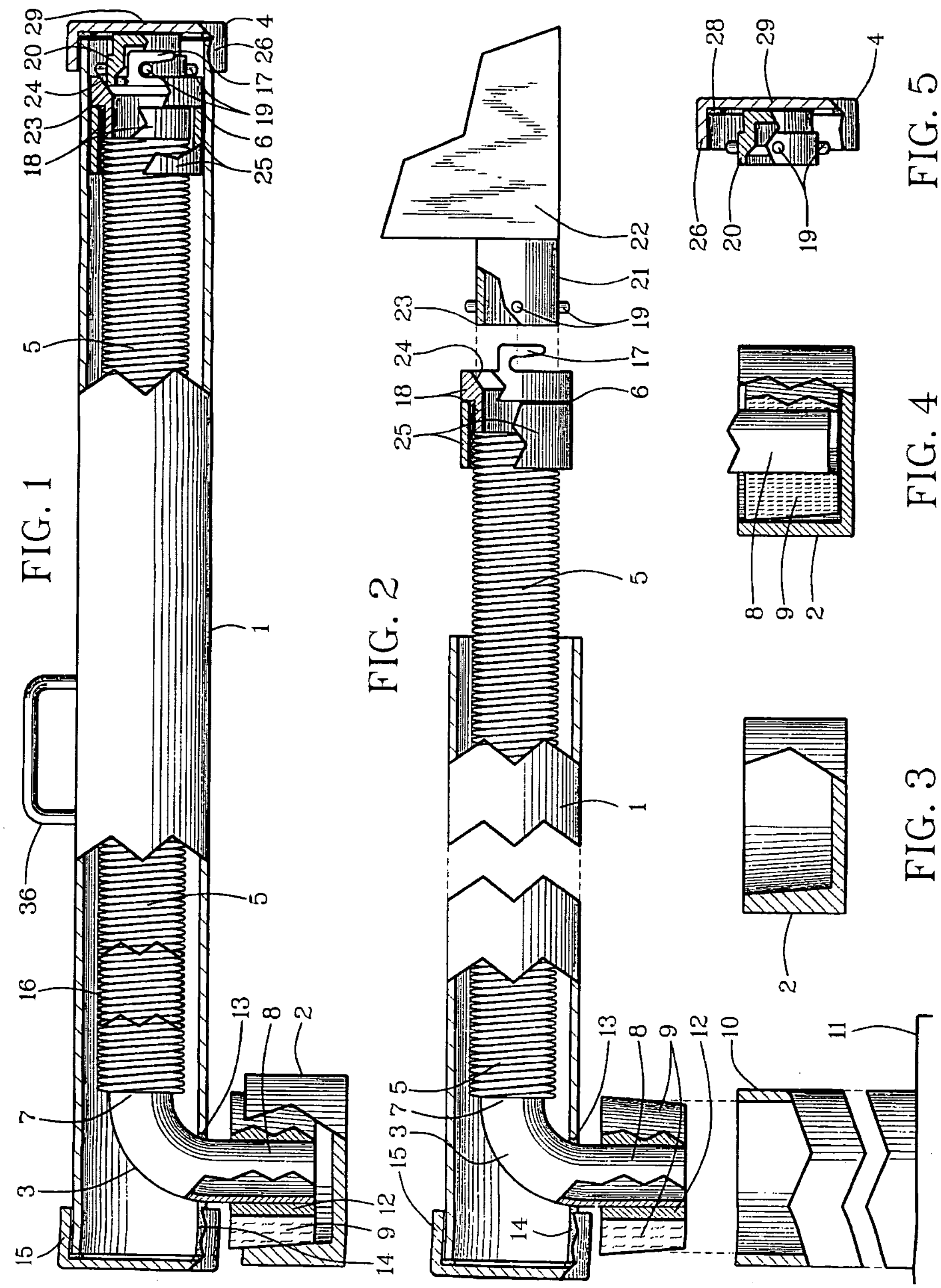


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

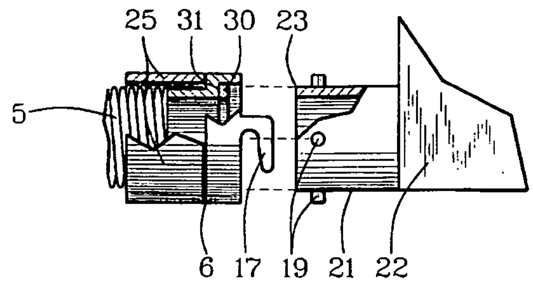


FIG. 6

FIG. 7

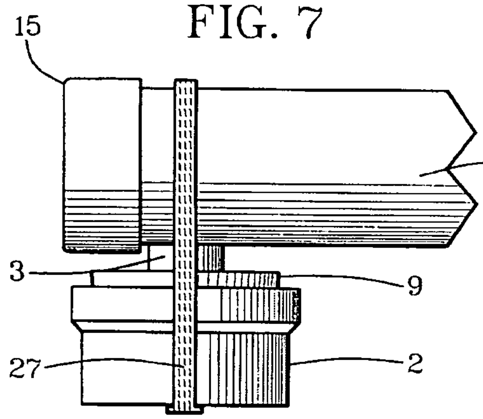


FIG. 8

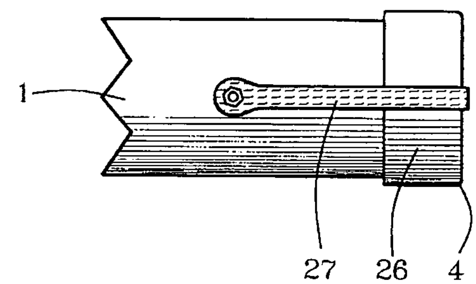


FIG. 9

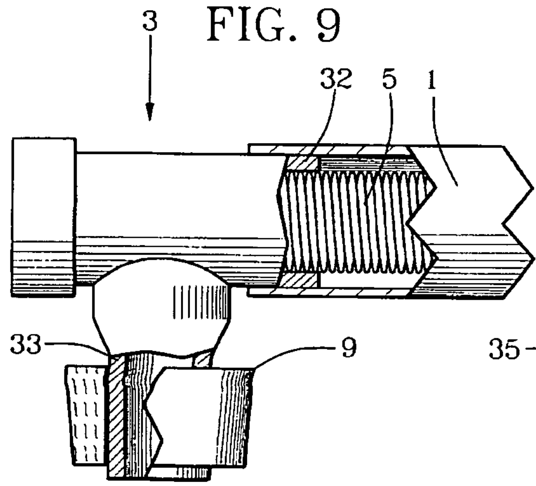
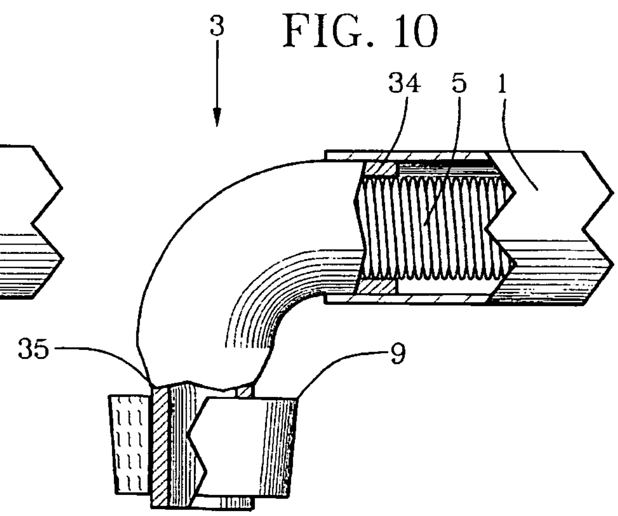


FIG. 10



RECREATIONAL VEHICLE WASTE DRAINER

BACKGROUND OF THE INVENTION

This invention relates to a drain tube for a recreational vehicle (RV) and in particular to a convolute drain tube carried in portable casing in which the drain tube is sealed when not in use and when being used has sealing attachment to RV sewage receptacles.

There is one unpleasant and at times gross aspect of an otherwise pleasurable way of life traveling and living in motor homes, campers and travel trailers which are known collectively as RV's. It is handling the sewage. Known drainer systems and devices involve messy, wet and horribly smelling contact with sewage-disposal items and conditions.

Examples of different but related RV sewage-handling devices are described in the following patent documents. U.S. Pat. No. 4,854,349, issued on Aug. 8, 1989 to Foreman, describes a sealable sleeve attached to a bottom of a recreational vehicle (RV) for holding an expandable sewage tube. U.S. Pat. No. 4,231,595, issued on Nov. 4, 1980 to Knutsen, describes a differently attached but similarly functional sleeve attached to a bottom of an RV for holding an expandable sewage tube. U.S. Pat. No. 4,223,702, issued on Sep. 23, 1980 to Cook, teaches a telescopically expandable sleeve for holding an expandable sewage tube intermediate an RV and a sewage receptacle. U.S. Pat. No. 4,180,102, issued on Dec. 25, 1979 to Larkin, taught a sleeve with half-circle sections held together with end rings for holding an expandable sewage tube. U.S. Pat. No. 4,133,347, issued on Jan. 9, 1979 to Mercer, described another sleeve attached to an RV bottom by attachment directly to a sewage-outlet pipe. Finally, U.S. Pat. No. 4,712,755, issued on Dec. 15, 1987 to Robbins, et al. teaches railing to hold an expandable sewage tube between an RV holding tank and a sewage receptacle.

Industry literature describes other devices but none having the features of this invention. The nearest known is a hose-carrier tube that can be mounted onto an RV.

SUMMARY OF THE INVENTION

In light of need for improvement of sewage handling for recreational vehicles, objects of this invention are to provide an RV waste drainer which:

- Is hand-portable in a sealed mode with a contracted sewage tube inside to prevent escape of objectionable odor and liquid when not in use, when being carried in an RV or when being stored wherever desired;
- Can be connected to a sewage receptacle easily and conveniently without contact with wet or soiled components;
- Seals easily and effectively to any size and type of conventional sewage-receptacle inlet;
- Allows clean, easy and convenient attachment of an expandable sewage tube to an outlet of a holding tank;
- Eliminates need for a special carrying compartment for a sewage hose;
- Can be marketed as a separate drainer unit for any type and size of RV; and
- Can be inexpensive to produce and long lasting.

This invention accomplishes these and other objectives with an RV-waste drainer having a drainer sheath with an angled drain nipple at a receptacle end. An expandable sewage tube inside of the drainer sheath has a drain end

attached to the drain nipple. A holding-tank connector on a holding-tank end of the expandable tube connects the expandable tube to an RV holding tank for draining it and connects the expandable tube to a sheath lid for sealing the drainer sheath and the expandable tube against escape of odorous gases and liquid at a tube end of the drainer sheath when not in use. The drain nipple has a beveled outside periphery that is resilient and sized to fit inside of input pipes to RV sewage receptacles. With the drain nipple resiliently sealed to an inside periphery of an input pipe, the holding-tank connector is disconnected from the sheath lid and attached to an RV holding tank with the holding-tank connector. A nipple lid has a nipple sleeve that fits onto the beveled outside periphery of the drain nipple like an input pipe to seal the drainer sheath against escape of odorous gases and liquid at the drain nipple.

The above and other objects, features and advantages of the present invention should become even more readily apparent to those skilled in the art upon a reading of the following detailed description in conjunction with the drawings wherein there is shown and described illustrative embodiments of the invention.

BRIEF DESCRIPTION OF DRAWINGS

This invention is described by appended claims in relation to description of a preferred embodiment with reference to the following drawings which are described briefly as follows:

FIG. **1** is a partially cutaway plan view of the RV-waste drainer in a storage mode;

FIG. **2** is a partially cutaway and partially cut-short plan view of the RV-waste drainer in relation to an RV holding tank and an RV sewage receptacle for a drainage mode;

FIG. **3** is a cutaway elevation view of a nipple lid having bevelled inside walls;

FIG. **4** is a cutaway elevation view of a nipple lid having parallel inside walls in relationship to a drain nipple;

FIG. **5** is a cutaway side view of a sheath lid;

FIG. **6** is a sectional cutaway side view of a holding-tank connector having an optional seal ring in working relationship to a holding-tank outlet pipe;

FIG. **7** is a sectional end view of a receptacle end of a drainer sheath having a resilient strap as a nipple-lid retainer;

FIG. **8** is a sectional end view of a sheath-tube end of a drainer sheath having a resilient strap as a sheath-lid retainer;

FIG. **9** is a partially cutaway sectional view of a receptacle end of a drainer sheath having an optional T-joint drain nipple; and

FIG. **10** is a partially cutaway sectional view of a receptacle end of a drainer sheath having an optional elbow-joint drain nipple.

DESCRIPTION OF PREFERRED EMBODIMENT

Reference is made first to FIG. **1** in the drawings. A drainer sheath **1** has a nipple lid **2** on a drain nipple **3** at a receptacle end and a sheath lid **4** on a sheath-tube end for a storage mode of the RV-waste drainer depicted in FIG. **1**. An expandable tube **5** with a design length contracted inside of the drainer sheath **1** has a holding-tank end attached to a holding-tank connector **6** and a drain end sealed peripherally to an inlet end **7** of the drain nipple **3**. The drain nipple **3** has a nipple-outlet end **8** that is angled designedly, preferably

ninety degrees, from the sheath axis. For the storage mode of the RV-waste drainer, a nipple-attachment wall **9** on the nipple-outlet end **8** is bevelled, resilient and sized to bevel-fit snugly inside of the nipple lid **2**.

Referring to FIG. **2**, the nipple-attachment wall **9** is sized and shaped also to seal-fit snugly into a design size range of receptacle pipes **10** of sewage receptacles **11** for a drainage mode of the RV-waste drainer. The nipple-attachment wall **9** can be attached directly to the nipple-outlet end **8** as depicted in FIG. 4 or can be attached with a nipple-attachment sleeve **12** as shown in FIGS. **1–2**. The nipple lid **2** can have inside peripheral walls that are bevelled in design proportion to walls of the nipple-attachment wall **9** as shown in FIGS. 1 and 3 or can have inside peripheral walls that are parallel as shown in FIG. 4.

A selection of means can be employed for attachment of the drain nipple **3** to the drainer sheath **1** and to the drain end of the expandable tube **5**. Depicted in FIGS. **1–2** are nipple bays **13** into which the drain nipple **3** is inserted and then affixed with an adhesive **14** to the drainer sheath **1**. A drain-end cap **15** then can be positioned on the receptacle end of the drainer sheath **1**. The drain end of the expandable tube **5** can have an inside periphery or an outside periphery sealed to the nipple-inlet end **7** of the drain nipple **3**, depending on the type and size of drain nipple **3**, expandable tube **5** and drainer sheath **1** employed. The expandable tube **5** can have an inside periphery sealed to an outside periphery of the nipple-inlet end **7** and an outside periphery of the expandable tube **5** sealed to an inside periphery of an internal extension of the receptacle end of the drainer sheath **1** as a design option.

The expandable tube **5** can be a convolute type having internally convoluted wires **16**, depicted in a cutaway in FIG. 1 or optionally an accordion type preferred by some users for a smoother interior, a telescopic type or foreseeably a stretch type without expansion crevices.

Referring to FIGS. **1–2** and **5**, a variety of holding-tank connectors **6** are foreseeable. One holding-tank connector **6** has a pair of hook threads **17** that are oppositely positioned on a connection end of a connector sleeve **18** that is sealed to an inside periphery of a holding-tank end of the expandable tube **5**. Boss threads **19** are extended radially from a tube-attachment sleeve **20** on the sheath lid **4** and similarly from a holding-tank outlet pipe **21** on an RV holding tank **22**. For sealing the sheath lid **4** onto the holding-tank connector **6** for storage mode, boss threads **19** are first positioned in the hook threads **17**. The holding-tank end of the expandable tube **5** is rotated in a rotational direction that forces the boss threads **19** into bays of the hook threads **17** and draws a circumferential seal ridge **23** on the tube-attachment sleeve **20** into sealing contact with an inwardly bevelled seal wall **24** on a tube end of the tube-attachment sleeve **20**.

Sealing the holding-tank connector **6** onto the holding-tank outlet pipe **21** of an RV holding tank **22** for drainage mode is the same as with the sheath lid **4** for storage mode, except that the boss threads **19** are on the holding-tank outlet pipe **21** instead of on the tube-attachment sleeve **20** of the sheath lid **4**. This is an edge-to-surface type of seal that is particularly effective for contaminating conditions such as occur in waste drainage.

Hand-holding the holding-tank end of the expandable tube **5** for rotating the hook threads **17** onto the boss threads **19** requires rigid grasping that can wear out and tear the expandable tube **5**. An unprotected expandable tube **5** also is smelly, often wet, repulsive and unsanitary. It is difficult to keep clean and to remove its odor and contaminants from hands and clothing. A tube handle **25** positioned externally to the expandable tube **5** proximate the connector sleeve **18**, therefore, is highly advantageous.

A preferred tube handle **25** is an impervious sleeve-like member that is either positioned on the expandable tube **5** where supported by the connector sleeve **18** internally or extended from the holding-tank connector **6**. Due to rigidity of the connector sleeve **18** inside of an end of the expandable tube **5**, it is not essential that the tube handle **25** be rigid, particularly if the connector sleeve **18** is long enough inside for rigid support of a flexible, resilient or wraparound tube handle **25** having handgrip length on the outside of the expandable tube **5**. A tube handle **25** that is either rigid, flexible, or pliable can be also a connector or holder of the expandable tube **5** onto an appropriately structured connector sleeve **18**.

Referring to FIGS. **1**, **5** and **8**, the sheath lid **4** has a sheath-attachment sleeve **26** with an inside periphery that fits onto an outside periphery of the sheath-tube end of the drainer sheath **1**. It can be fit tightly, screwed on with threads or forced on with a resilient strap **27** as a sheath-lid retainer. A sheath-lid seal ring **28** can be positioned for linear sealing between a lid plate **29** and the sheath-tube end of the drainer sheath **1**. The tube-attachment sleeve **20** is attached to and extended from the lid plate **29**.

Referring to FIGS. **1–4** and **7**, a resilient strap **27** also can be used as a nipple-lid retainer. Also foreseeable are threads, hooks and non-resilient straps for lid retainers.

Referring to FIGS. **1–2** and **5–6**, a tube-seal ring **30** can be positioned intermediate a tube end of the tube-attachment sleeve **20** or a holding-tank outlet pipe **21** and a circumferential seal wall **31** proximate the holding-tank end of the holding-tank connector **6**. The tube end of the tube-attachment sleeve **20** or the holding-tank outlet pipe **21** and the circumferential seal wall **31** are forced against opposite sides of the tube-seal ring **30** by the holding-tank connector **6**. The circumferential seal wall **31** has an inside diameter and an outside diameter that are designedly equal to an inside diameter and an outside diameter of the tube-attachment sleeve **20** and that are designedly equal to an inside diameter and an outside diameter of a holding-tank outlet pipe **21**, such that sealed connection of the expandable tube **5** to the sheath lid **4** is designedly similar to sealed connection of the expandable tube **5** to the holding-tank outlet pipe **21** for respectively storage mode and drainage mode of the RV-waste drainer.

This is a surface-to-surface seal that is optional to the edge-to-surface seal described in relation to FIGS. **1–2** and **5**. It can be used also in combination with the edge-to-surface seal by tapering the tube-seal ring **30** and positioning it on the inwardly bevelled seal wall **24**.

Referring to FIG. **9**, the drain nipple **3** can be a T-joint having a first-end portion **32** attached to the drainer sheath **1** and sealed to the expandable tube **5**. A second-end portion **33** is extended at a design angle from the receptacle end of the drainer sheath **1** and designedly bevelled resilient tubing such as a nipple-attachment wall **9** is affixed peripherally to the second-end portion **33** for a T-joint drain nipple **3**.

Referring to FIG. **10**, the drain nipple **3** can be an elbow joint having a first-end portion **34** attached to the drainer sheath **1** and sealed to the expandable tube **5**. A second-end portion **35** is extended at a design angle from the receptacle end of the drainer sheath **1** and designedly bevelled resilient tubing such as a nipple-attachment wall **9** is affixed peripherally to the second-end portion **35** for an elbow-joint drain nipple **3**.

The T-joint drain nipple 3 of FIG. 9 and the elbow-joint drain nipple 3 of FIG. 10 are representative of options that are foreseeable for attaching the drain nipple 3 to the receptacle end of the drainer sheath 1 with the nipple-outlet end 8 angled designedly from the sheath axis. Select sizes of select ends of the drain nipple 3 can be matched with select sizes of drainer sheaths 1 and expandable tubes 5 in accordance with design preferences for different use conditions and for different sizes of receptacle pipes 10.

Referring further to FIG. 1, a drainer handle 36 is positioned on a side of the drainer sheath 1 that is opposite from angled extension of the drain nipple 3 and designedly weight-centered between the sheath-tube end and the receptacle end of the RV-waste drainer for ease of transport, storage and use.

A new and useful RV-waste drainer having been described, all such foreseeable modifications, adaptations, substitutions of equivalents, mathematical possibilities of combinations of parts, pluralities of parts, applications and forms thereof as described by the following claims and not precluded by prior art are included in this invention.

What is claimed is:

1. An RV-waste drainer comprising:

a drainer sheath having a sheath-tube end, a receptacle end, a sheath inside periphery, a sheath outside periphery and a sheath axis;

a drain nipple attached to the receptacle end of the drainer sheath;

the drain nipple having a nipple-outlet end that is angled designedly from the sheath axis;

a nipple-attachment wall that is beveled, resilient and sized to bevel-seal fit snugly against an inside periphery of a design size range of receptacle pipes of sewage receptacles for a drainage mode of the RV-waste drainer;

a design length of expandable tube inside of the drainer sheath;

the expandable tube having a holding-tank end and a drain end;

a holding-tank connector on the holding-tank end of the expandable tube;

the drain end of the expandable tube being sealed peripherally to an inlet end of the drain nipple;

the expandable tube being expandable selectively from the sheathe-tube end of the drainer sheath and positioned with the holding-tank end of the expandable tube being sealed detachably to a holding-tank outlet with the holding-tank connector for a drainage mode of the RV-waste drainer;

a sheath lid that is attached detachably in sealing connection to the sheath-tube end of the drainer sheath and that is attached detachably to the holding-tank end of the expandable tube with the holding-tank connector being a detachable attachment of the sheath lid to the expandable tube for a storage mode of the RV-waste drainer; and

a nipple lid with a lid sleeve extended from an inside surface of the nipple lid and the lid sleeve having an inside periphery that is sized to seal against the nipple-attachment wall for a storage mode of the RV-waste drainer, such that opposite ends of the drainer sheath can be sealed with the expandable tube contained in the drainer sheath for storage mode and such that the drain nipple can be sealed in a receptacle pipe and the expandable tube can be extended from the drainer sheath and attached to the holding-tank outlet for drainage mode of the RV-waste drainer, respectively, as selected.

2. An RV-waste drainer as described in claim 1 wherein:

the drainer sheath is a pipe made of a designedly light-weight, strong and impervious material having an interior diameter sized to receive either of a design size range of expandable tubes and having a length to receive a design length of select expandable tube in a contracted mode.

3. An RV-waste drainer as described in claim 2 wherein:

the drain nipple is a pipe elbow made of a designedly light-weight, strong and impervious material;

the drain end of the expandable tube is sealed to a first end of the pipe elbow;

the pipe elbow is affixed to a side of the receptacle end of the drainer sheath; and

a second end of the pipe elbow is extended at a design angle from the drainer sheath.

4. An RV-waste drainer as described in claim 3 wherein:

the nipple-attachment wall that is bevelled is a rubberlike material having an inside periphery that is affixed to an outside periphery of the outside end of the pipe elbow.

5. An RV-waste drainer as described in claim 4 wherein:

the inside periphery of the lid sleeve has a diameter that is equal to a design section of outside periphery of the nipple-attachment wall that is bevelled.

6. An RV-waste drainer as described in claim 4 wherein:

the inside periphery of the lid sleeve is bevelled in design proportion to a bevel angle of the nipple-attachment wall that is bevelled.

7. An RV-waste drainer as described in claim 4 and further comprising:

a nipple-lid retainer.

8. An RV-waste drainer as described in claim 7 wherein:

the nipple-lid retainer is a resilient strap having contraction force intermediate the nipple lid and the drainer sheath.

9. An RV-waste drainer as described in claim 1 and further comprising:

a drainer handle on a side of the drainer sheath that is opposite from angled extension of the drain nipple and designedly weight-centered between the sheath-tube and the receptacle end of the RV-waste drainer.

10. An RV-waste drainer as described in claim 1 wherein:

the drain nipple is an elbow joint made of a designedly light-weight and strong material;

a first-end portion of the elbow joint is attached to the drainer sheath and sealed to the expandable tube;

a second-end portion of the elbow joint is extended at a design angle from the receptacle end of the drainer sheath; and

designedly bevelled resilient tubing is affixed peripherally to the second-end portion of the elbow joint.

11. An RV-waste drainer as described in claim 1 wherein:

the drain nipple is a T-joint made of a designedly light-weight and strong material;

a first-end portion of the T-joint is attached to the drainer sheath and sealed to the expandable tube;

a second-end portion of the T-joint is extended at a design angle from the receptacle end of the drainer sheath; and

designedly bevelled resilient tubing is affixed peripherally to the second-end portion of the T-joint.

12. An RV-waste drainer as described in claim 1 wherein:

the sheath lid has a sheath-attachment sleeve extended from an inside surface of a lid plate; and

the sheath-attachment sleeve has an inside periphery that is sized and shaped to fit snugly onto an outside periphery of the sheath-tube end of the drainer sheath for sealing against escape of odorous gases and liquids from the expandable tube.

13. An RV-waste drainer as described in claim 1 wherein:

the sheath lid has a sheath-attachment sleeve extended from an inside surface of a lid plate; and

the lid plate has a resilient inside surface against which the sheath-tube end of the drainer sheath is pressured in sealing contact by the holding-tank connector to prevent escape of odorous gases and liquids from inside of the expandable tube.

14. An RV-waste drainer as described in claim 1 wherein:

the sheath lid has a tube-attachment sleeve extended from an inside surface of a lid plate;

the holding-tank connector has an inwardly beveled seal wall at a connection end;

a tube end of the tube-attachment sleeve has a circumferential seal ridge with a circumferential edge;

the circumferential edge of the circumferential seal ridge is forced against the inwardly beveled seal wall at the connection end of the holding-tank connector by bevel action of the holding-tank connector for sealing the sheath lid to the expandable tube for storage mode of the RV-waste drainer.

15. An RV-waste drainer as described in claim 14 wherein:

the circumferential seal ridge on the tube end of the tube-attachment sleeve on the sheath lid has an inside diameter and an outside diameter that are designedly equal to an inside diameter and an outside diameter of an RV holding-tank outlet pipe, such that sealed connection of the expandable tube to the sheath lid is designedly similar to sealed connection of the expandable tube to the RV holding-tank outlet pipe for respectively storage mode and drainage mode of the RV-waste drainer.

16. An RV-waste drainer as described in claim 15 wherein:

the holding-tank end of the expandable tube has a tube handle to which the holding-tank end of the expandable tube and the holding-tank connector are affixed rigidly;

the tube handle being sized and shaped for convenient handling of the expandable tube and the holding-tank connector without damage to and without hand-contact with the expandable tube and contaminated parts of the holding-tank connector when the expandable tube is being extended from inside of the drainer sheath to a holding-tank outlet for drainage mode of the RV-waste drainer and when the holding-tank connector is being connected to and disconnected from the holding-tank outlet.

17. An RV-waste drainer as described in claim 16 wherein:

the tube handle is a sleeve member positioned proximate the holding-tank connector and being circumferentially external to an outside periphery of a select portion of the holding-tank end of the expandable tube.

18. An RV-waste drainer as described in claim 1 wherein:

the sheath lid has a tube-attachment sleeve extended from an inside surface of a lid plate;

a tube-seal ring is positioned intermediate a tube end of the tube-attachment sleeve and a circumferential seal wall proximate the holding-tank end of the holding-tank connector; and

the tube end of the tube-attachment sleeve and the circumferential seal wall are forced against opposite sides of the tube-seal ring by the holding-tank connector for sealing the sheath lid to the expandable tube for storage mode of the RV-waste drainer.

19. An RV-waste drainer as described in claim 18 wherein:

the circumferential seal wall has an inside diameter and an outside diameter that are designedly equal to an inside diameter and an outside diameter of the tube-attachment sleeve and that are designedly equal to an inside diameter and an outside diameter of a holding-tank outlet pipe, such that sealed connection of the expandable tube to the sheath lid is designedly similar to sealed connection of the expandable tube to the holding-tank outlet pipe for respectively storage mode and drainage mode of the RV-waste drainer.

20. An RV-waste drainer as described in claim 1 wherein:

the holding-tank end of the expandable tube has a tube handle to which the holding-tank end of the expandable tube and the holding-tank connector are affixed rigidly;

the tube handle being sized and shaped for convenient handling of the expandable tube and the holding-tank connector without damage to or hand-contact with the expandable tube or contaminated parts of the holding-tank connector when the expandable tube is being extended from inside of the drainer sheath to a holding-tank outlet for drainage mode of the RV-waste drainer and when the holding-tank connector is being connected to and disconnected from the holding-tank outlet.

21. An RV-waste drainer as described in claim 20 wherein:

the tube handle is a sleeve member positioned proximate a holding-tank connector and being circumferentially external to an outside periphery of a select portion of the holding-tank end of the expandable tube.

22. An RV-waste drainer as described in claim 1 and further comprising:

a sheath-lid retainer.

23. An RV-waste drainer as described in claim 22 wherein:

the sheath-lid retainer is a resilient strap having contraction force intermediate the sheath lid and the drainer sheath.

* * * * *

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United States Patent [19]

DiBiagio et al.

[11] **Patent Number: 5,951,082**

[45] **Date of Patent: *Sep. 14, 1999**

[54] **FLEXIBLE PLUMBING ASSEMBLY**

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[73] Assignee: **Monaco Coach Corporation**, Coburg, Oreg.

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **09/122,529**

[22] Filed: **Jul. 24, 1998**

Related U.S. Application Data

[63] Continuation of application No. 08/821,905, Mar. 21, 1997, Pat. No. 5,816,639, which is a continuation of application No. 08/520,166, Aug. 25, 1995, Pat. No. 5,658,031.

[51] **Int. Cl.**[6] **B60R 27/00**

[52] **U.S. Cl.** **296/26.13**; 296/165; 296/156

[58] **Field of Search** 296/26.09, 26.13, 296/136, 165, 171, 175

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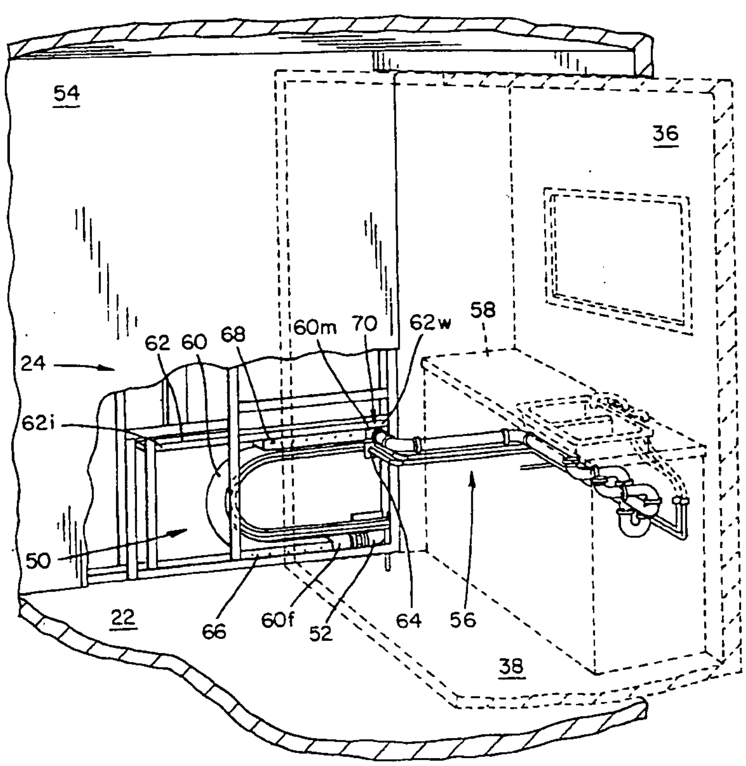
5,816,639	10/1998	DiBiagio et al.	296/26.13

Primary Examiner—Joseph D. Pape
Attorney, Agent, or Firm—Leydig, Voit & Mayer, Ltd

[57] **ABSTRACT**

A flexible plumbing assembly for use in a trailer with an extensible cabin having rigid plumbing that can be moved between a retracted position wherein the extensible cabin is substantially inside the trailer and an extended position wherein the extensible cabin is substantially outside the trailer. The flexible plumbing assembly comprising a flexible hose connecting the trailer rigid plumbing to the cabin rigid plumbing, a sliding guide for horizontally moving the connection of the flexible hose to the cabin rigid plumbing at a constant elevation relative to the cabin floor as the cabin rigid plumbing moves with the cabin between the extended and retracted positions, and hose guide for ensuring that material in the flexible hose moves in the proper direction as the cabin moves between the extended and retracted positions. In the preferred embodiment the sliding guide comprises a support bracket which holds the connection of the flexible hose to the cabin rigid plumbing and is slidably attached to a track that is generally parallel to both the floor and the front and rear walls of the cabin.

27 Claims, 3 Drawing Sheets



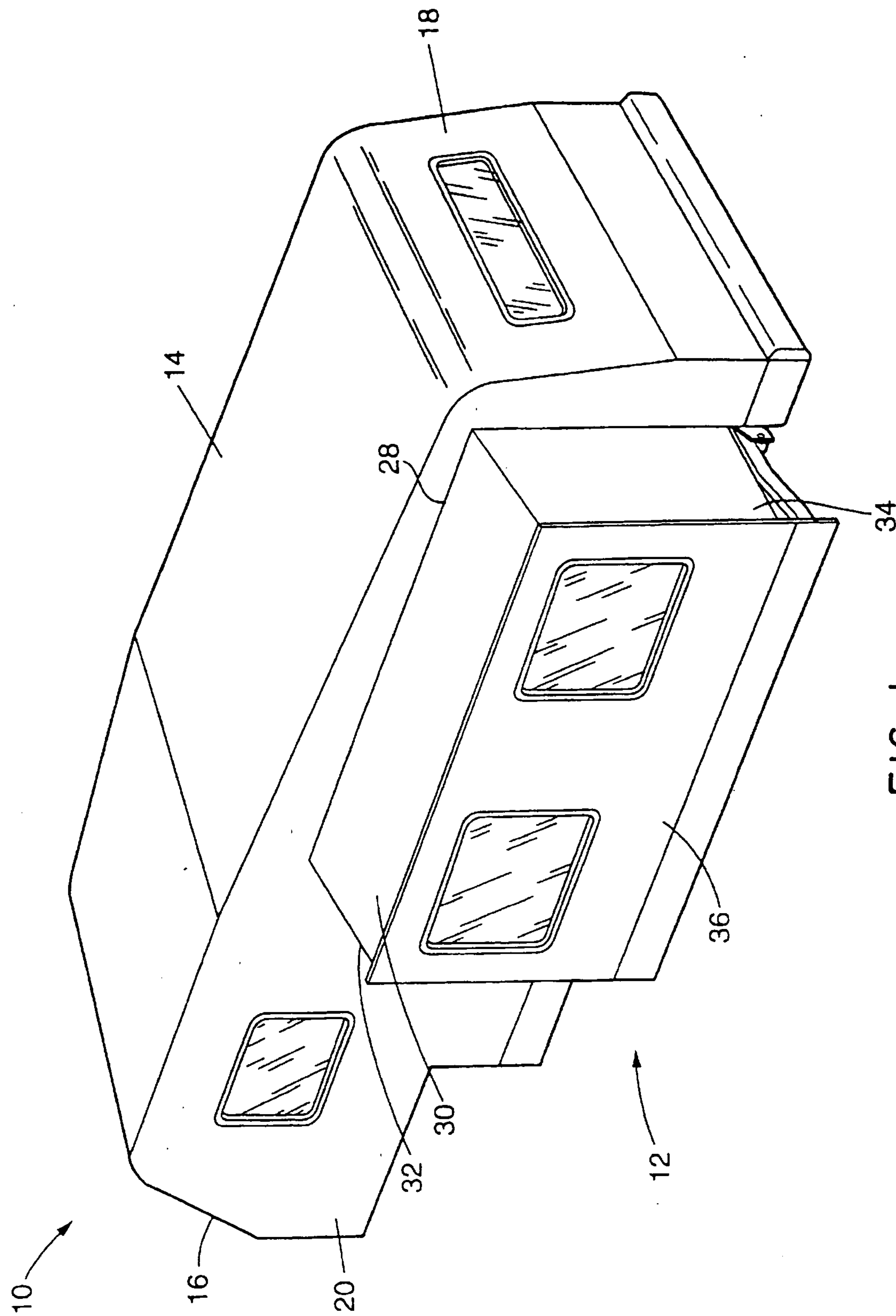


FIG. 1

FIG. 2

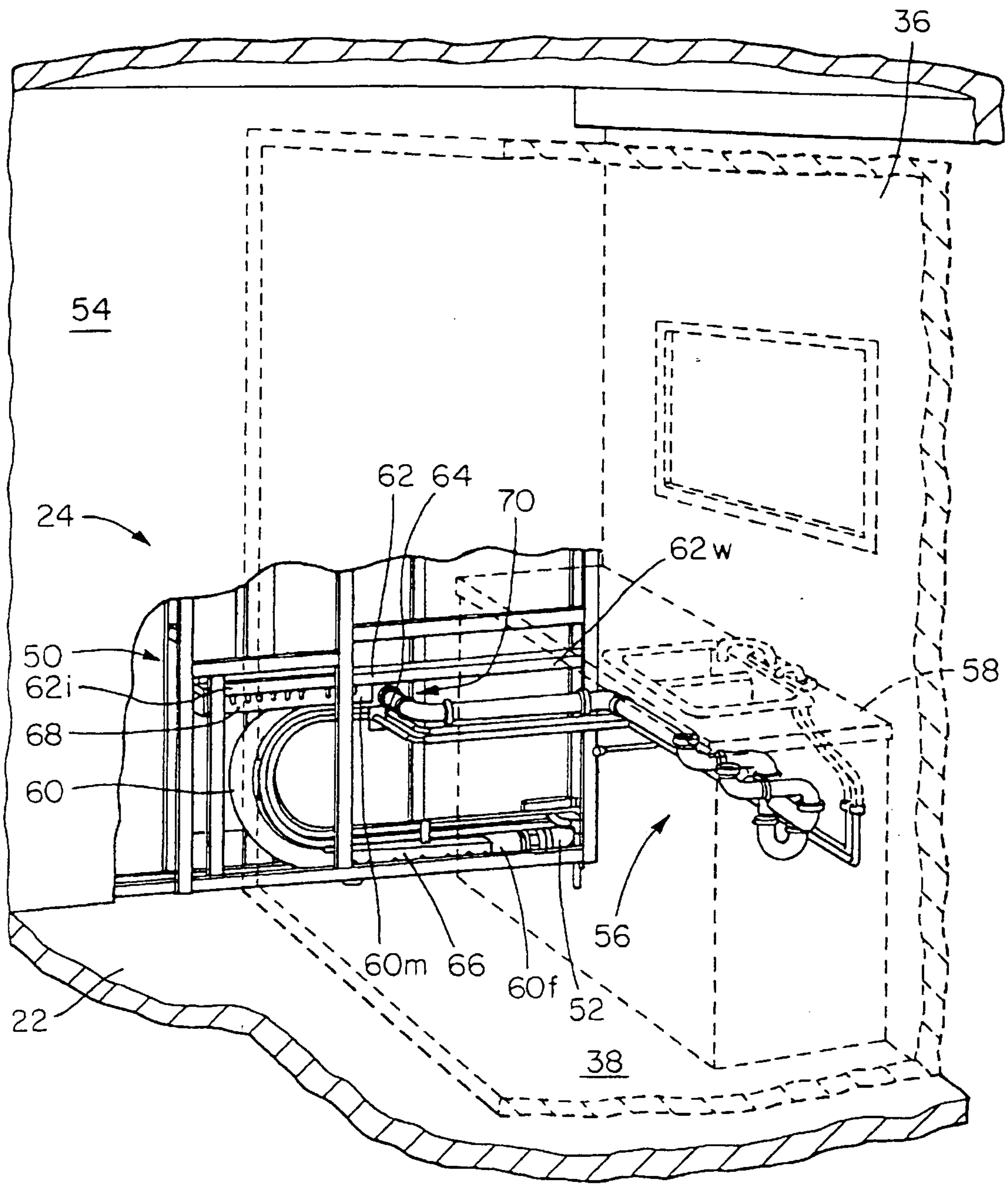
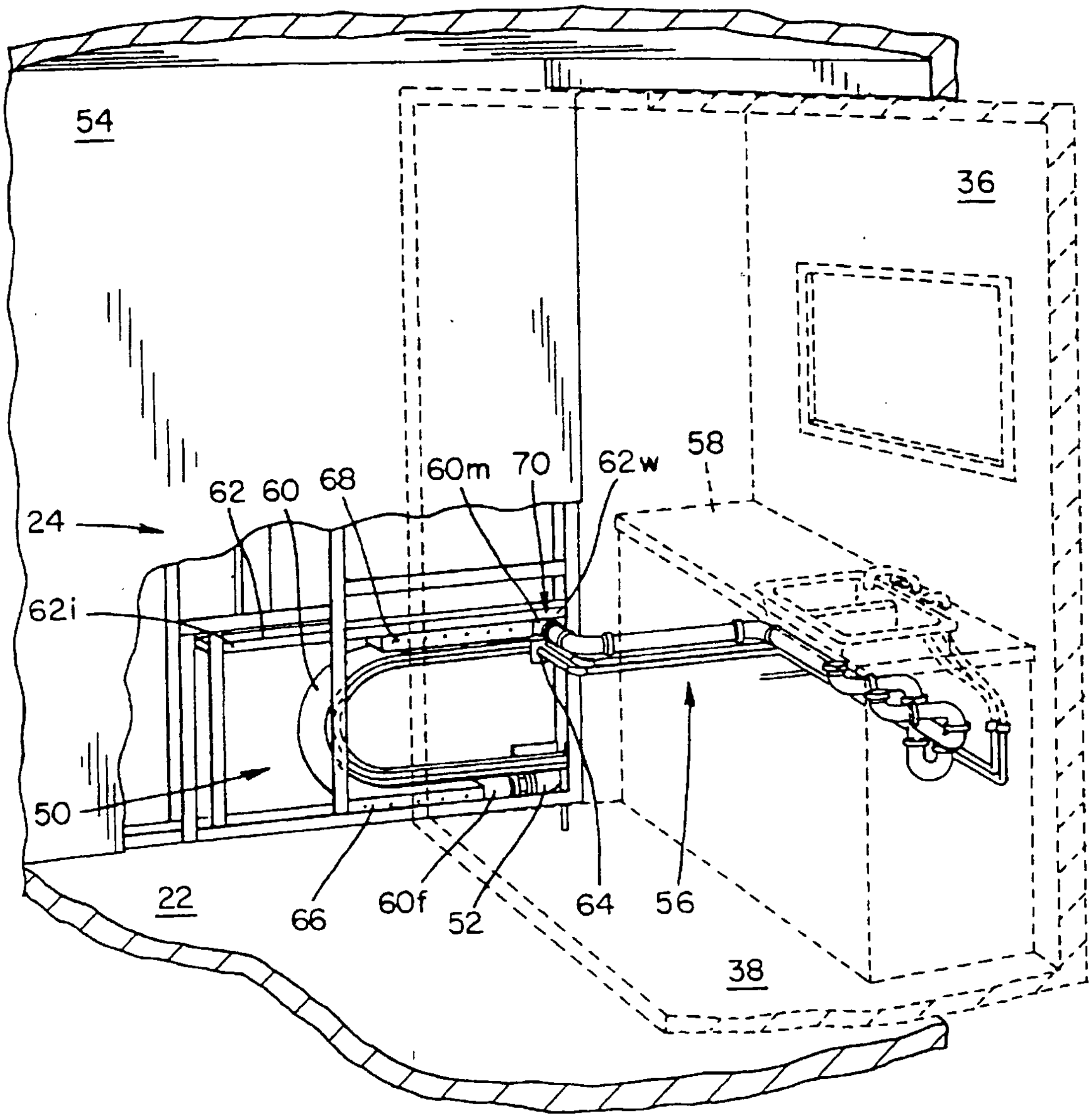


FIG. 3



FLEXIBLE PLUMBING ASSEMBLY

This is a continuation of Ser. No. 08/821,905, filed Mar. 21, 1997, now U.S. Pat. No. 5,816,639 which is a continuation of Ser. No. 08/520,166 filed Aug. 25, 1995, now U.S. Pat. No. 5,658,031.

FIELD OF THE INVENTION

This invention generally relates to flexible plumbing assemblies and, more particularly, to flexible plumbing assemblies for use in travel trailers, fifth wheel trailers, motor homes, recreational vehicles and the like provided with extensible room portions for increasing the living space in the trailer.

BACKGROUND OF THE INVENTION

Many travel trailers have a central or main room containing an extensible cabin portion which is laterally extendable in order to increase the interior space of the trailer when the trailer is parked at its final destination. The extensible cabin portion is typically slidably supported upon the floor of the main room for movement between a stored, retracted position and an extended position.

Typically, the kitchen and bathroom areas had to be located in the central room which does not move, in order to accommodate the rigid plumbing necessary for waste disposal lines, water lines, and gas lines. Therefore, generally only the living room section could be extended out from the central room. Unfortunately, separating the kitchen/bathroom from the extensible room prevents the usable area in the central cabin area from being maximized.

Attempts to locate the kitchen and bathroom areas in the extensible cabin portion have been relatively unsuccessful. One solution to locating the kitchen and bathroom areas in the extensible cabin portion is to provide for connection to the utility lines by quick release connectors. The use of quick release connectors, however, necessitates manually connecting and disconnecting the utility lines each time the extensible cabin portion is moved into the extended position. This can lead to an increased likelihood of a poor connection causing leakage. Further, this leakage could lead to safety problems.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the invention to provide a vehicle, such as a mobile home, house trailer, recreational vehicle, or the like having a laterally extensible cabin with kitchen and/or bathroom areas that does not require manual connection of plumbing.

It is an object of the invention to provide a flexible plumbing assembly permitting the extensible cabin portion of a trailer, mobile home, recreational vehicle or the like to contain areas needing rigid plumbing such as kitchen and bathroom areas thereby increasing the usable interior space of the main room of the trailer.

It is an object of the invention to provide a flexible plumbing assembly which allows the rigid plumbing in the extensible cabin portion to be used in both the extended and retracted positions.

It is a related object to provide a flexible plumbing assembly that does not require manual disconnection of the rigid plumbing in the trailer from the rigid plumbing in the extensible cabin portion when the cabin is moved from the retracted to the extended positions.

It is a related object to provide a flexible plumbing assembly which allows the rigid plumbing in the extensible cabin to be used when the trailer is moving.

Another object of the present invention is to provide a flexible plumbing assembly that maintains a proper drain slope as the extensible cabin moves between the extended and retracted positions.

These and other features and advantages of the invention will be more readily apparent upon reading the following description of a preferred exemplified embodiment of the invention and upon reference to the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a fifth wheel trailer with an extensible cabin in the extended position;

FIG. 2 is a perspective cut away view showing the flexible plumbing assembly disposed within the panel wall in the central room of the trailer and the extensible cabin (in broken lines) in the retracted position;

FIG. 3 is perspective cut away view showing the flexible plumbing assembly disposed within the panel wall in the central room of the trailer and the extensible cabin (in broken lines) in the extended position.

While the invention will be described and disclosed in connection with certain preferred embodiments and procedures, it is not intended to limit the invention to those specific embodiments. Rather it is intended to cover all such alternative embodiments and modifications as fall within the spirit and scope of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and particularly to FIG. 1, the trailer **10** has an extensible cabin or room **12** and a slideout mechanism (not shown), and a flexible plumbing assembly **50**. Although the illustrated trailer is of the "fifth wheel" type which is adapted to be towed by a vehicle (not shown) disposed at the front end, it will be appreciated that the invention is applicable to any type of expandable vehicle or trailer.

The trailer **10** generally has a ceiling **14**, a front wall **16**, a rear wall **18**, two opposing side walls **20** (only the left wall is shown), and a floor **22** which generally define an interior living space or central room **24**. In the illustrated embodiment, the left side wall **20** has an opening **28** for receiving the extensible cabin **12**. The extensible cabin **12** has a cabin ceiling **30**, a front wall **32**, a rear wall **34**, side wall **36**, and a floor **38**.

The extensible cabin **12** is movable between an extended position generally shown in FIG. 1 and in broken lines in FIG. 3 and a retracted position generally shown in broken lines in FIG. 2. In the extended position, the extensible cabin **12** is extended outwardly from the interior trailer space **24** which increases the overall space available inside the trailer **10**. In the retracted position, the cabin **12** is positioned inwardly into the interior space **24** of the trailer **10** which decreases the exterior dimensions of the trailer **10** for towing and transport over the highways. The trailer **10** has a slideout mechanism (not shown) for positioning the cabin **12** between the retracted and extended positions. U.S. patent application Ser. No. 08/311,945 dated Sep. 26, 1994, which is incorporated by reference, describes several different slideout mechanisms.

The trailer **10** has a flexible plumbing assembly **50** for maintaining the connection between rigid plumbing in the

interior space 24 of the trailer and rigid plumbing in the extensible cabin 12 as the extensible cabin moves between the extended and retracted positions, in accordance with the present invention. The trailer plumbing system may include water or propane supply tanks or storage tanks for waste water and other waste material disposed in the interior space 24 of the trailer. In addition, the plumbing system may include hot and cold water supply lines and drain lines for sinks and a shower, propane supply lines for a gas stove, or drain lines for waste material from a toilet all located in the extensible cabin 12.

As best shown in FIG. 2, the trailer 10 has a plumbing system with rigid plumbing located in both the interior space 24 of the trailer 10 and in the extensible cabin 12 (in broken lines). The interior plumbing 52 is disposed within a panel wall 54 located in the interior space 24 of the trailer 10. The extensible cabin plumbing 56 is contained within a cabinet 58 located along the side wall 36 of the extensible cabin 12. The flexible plumbing assembly 50 connects the interior plumbing 52 to the extensible cabin plumbing 56 enabling material such as water, waste, or gas to be transported several feet horizontally between the interior space and the extensible cabin when the extensible cabin is in the extended position. Although the illustrated extensible cabin plumbing means is a sink with a double wash basin and a gas line for a stove (not shown) along the side wall 36 of the extensible cabin 12, it will be appreciated that the invention is applicable to any type of rigid plumbing that is located within the extensible cabin 12.

The flexible plumbing assembly 50 may comprise a flexible hose, means for horizontally sliding the connection of the flexible hose to the cabin plumbing at the same elevation relative to the floor of the extensible cabin as the extensible cabin moves between the extended and retracted positions, and means for guiding the flexible hose so that the flexible hose maintains a slope sufficient to allow for waste to drain in the proper direction as the extensible cabin moves between the extended and retracted positions.

The flexible hose 60 has a fixed end 60*f* and a movable end 60*m* as shown in FIG. 2. In the illustrated embodiment, the fixed end 60*f* of the flexible hose 60 is attached to the rigid interior plumbing 52. The movable end 60*m* of the flexible hose 60 is attached to the extensible cabin rigid plumbing 56. The flexible hose 60 is comprised of a flexible material that can bend to accommodate the movement of the extensible cabin 12 between the retracted and extended positions. The flexible hose may be made from any flexible material which will be known to those skilled in the art including, but not limited to, PVC. Further, those skilled in the art will appreciate that the diameter of the flexible hose is dependent upon the size of the trailer and the type of interior plumbing and extensible cabin plumbing the flexible hose is being used to connect. The flexible hose can have a diameter that ranges anywhere from ¼ inch to 6 inches. In addition, the flexible hose 60 must be of length sufficient to reach the extensible cabin rigid plumbing 56 when the extensible cabin 12 is in the extended position. It will be appreciated that the flexible hose 60 can be used to connect rigid propane, hot and cold water supply, drainage, and sewage plumbing in the interior space 24 to like plumbing in the extensible cabin 12.

The sliding means comprises a track 62 and a support bracket 64, as depicted in FIG. 2. As illustrated the track 62 and the support bracket 64 are disposed in the hollow interior of the panel wall 54 that is positioned in the interior space 24 so that it is generally parallel to the extensible cabin 12 front wall 32 and rear wall 34. Further, the track 62 is disposed so that it runs generally parallel to both extensible cabin floor 38 and the front and rear walls 32 and 34 of the extensible cabin 12. For ease of reference, the track 62 has an interior end referenced as 62*i* and an outboard or wall end referenced as 62*w*, as shown in FIGS. 2 and 3. The track 62 is adapted to receive the support bracket 64.

The support bracket 64 is adapted to receive and support the connection 70 between the flexible hose movable end 60*m* and the extensible cabin rigid plumbing 56. In order to accommodate the horizontal movement of the extensible cabin rigid plumbing 56 relative to the interior space rigid plumbing 52, the support bracket 64 is slidably connected to the underside of the track 62. The support bracket 64 is disposed at the track interior end 62*i* when the extensible cabin 12 is in the retracted position, as shown in FIG. 2. As the extensible cabin 12 is moved towards the extended position, the support bracket 64 travels horizontally along the track 62 towards the outboard or wall end 62*w* of the track in unison with the extensible cabin 12. In addition, the support bracket 64 is maintained at a constant level above the extensible cabin floor 38 in order to accommodate the fixed elevation of the extensible cabin rigid plumbing 56 relative to the extensible cabin floor 38. Thus, when the extensible cabin 12 is in the fully extended position, the support bracket 64 is at the outboard or wall end 62*w* of the track and the flexible hose 60 has bent to accommodate the movement from the retracted to the extended positions, as shown in FIG. 3. In this manner the connection between the movable end of the flexible hose 60*m* and the extensible cabin plumbing 56 moves along both in unison with the extensible cabin 12 and at a constant level above the extensible cabin floor 38 as the extensible cabin 12 causes the extensible cabin plumbing 56 to move horizontally between the extended and retracted positions.

The flexible hose guiding means comprises a fixed hose guide 66 and a movable hose guide 68. The fixed hose guide 66 is disposed along the bottom of the panel wall 54 where the flexible hose runs generally parallel to the trailer floor 22. The movable hose guide 68 is disposed on the underside of the track 62 where the flexible hose also runs generally parallel to the trailer floor 22. Further, the movable hose guide 68 is both rigidly attached to the support bracket 64 and slidably attached to the track 62. Thus, as the extensible cabin 12 moves between the retracted and extended positions, the movable hose guide 68 moves in unison with the support bracket 64 towards the outboard or wall end 62*w* of the track. In order to ensure that material in the flexible hose drains in the proper direction in the areas where it tends to run horizontally, the hose guiding means can be adjusted to provide any predetermined slope in the flexible hose that is necessary to insure proper drainage or to meet any applicable regulations. In the preferred embodiment, both the fixed hose guide 66 and the movable hose guide 68 are adapted to hold the flexible hose 60 so that a one quarter inch per foot slope is maintained in the areas where the flexible hose tends to run horizontally.

Thus, it will be seen that a novel and improved flexible plumbing assembly for use in slideout trailers has been provided which attains the aforementioned objects. Various additional modifications of the embodiment specifically illustrated and described herein will be apparent to those skilled in the art, particularly in light of the teachings of this invention.

We claim as our invention:

1. A flexible plumbing system for use in a recreational vehicle having a fixed cabin including a floor and a wall structure, and a movable cabin having a floor and a wall

structure movable between extended and retracted positions relative to the fixed cabin, said flexible plumbing system comprising at least one pipe in the fixed cabin having an opening at one end for enabling the flow of material through the fixed cabin pipe, at least one pipe in the movable cabin having an opening at one end for enabling the flow of material through the movable cabin pipe, a flexible hose having fixed and movable ends, a first connection for connecting the fixed hose end to the opening of the fixed cabin pipe, and a second connection for connecting the movable hose end to the opening of the movable cabin pipe, and support means for operatively supporting at least one of the first and second hose connections relative to the other of the first and second hose connections for enabling material to flow through the flexible hose in a desired direction between the fixed cabin pipe and movable cabin pipe regardless of the location and movement of the movable cabin between the extended and retracted positions.

2. The flexible plumbing system as set forth in claim **1** wherein said support means supports the second hose connection at an elevation substantially above the first hose connection so that the material flows from the movable pipe opening towards the fixed pipe opening.

3. The flexible plumbing system as set forth in claim **1** wherein the second hose connection is disposed at a substantially constant elevation relative to the movable cabin floor as the movable cabin extends and retracts.

4. The flexible plumbing system as set forth in claim **1** including a track operatively attached to the wall structure of the movable cabin for receiving the support means, and the track has inboard and outboard ends, and the support means is slidably attached to the track for movement between inboard and outboard ends of the track, wherein the support means moves between the inboard end when the movable cabin is in the retracted position and the outboard end when the movable cabin is in the extended position.

5. The flexible plumbing system as set forth in claim **1** wherein the support means supports at least one of the first and second hose connections at a substantially constant elevation relative to the movable cabin floor as the movable cabin moves between the extended and retracted positions.

6. The flexible plumbing system as set forth in claim **1** wherein the support means supports the first hose connection for creating a desired drainage slope in the flexible hose.

7. The flexible plumbing system as set forth in claim **1** wherein the support means includes a bracket that supports the second hose connection above the first hose connection as the movable cabin moves between the extended and retracted positions.

8. The flexible plumbing system as set forth in claim **7** wherein the bracket is disposed to maintain the elevation of the second hose connection relative to the first hose connection so that the flexible hose forms a slope sufficient to allow material to drain in the desired direction when the movable cabin is positioned between the extended and retracted positions.

9. The flexible plumbing system as set forth in claim **8** wherein the slope is at least about one quarter inch per foot.

10. The flexible plumbing system as set forth in claim **7** wherein the second hose connection is disposed at a substantially constant elevation relative to the movable cabin floor as the movable cabin extends and retracts.

11. The flexible plumbing system as set forth in claim **7** including a track operatively attached to the wall structure of the movable cabin for receiving the bracket, and the track has inboard and outboard ends, and the bracket is slidably attached to the track for movement between the inboard and outboard ends of the track wherein the bracket moves between the inboard end when the movable cabin is in the retracted position and the outboard end when the movable cabin is in the extended position.

12. The flexible plumbing system as set forth in claim **1** wherein the support means includes a bracket that supports the first hose connection for creating a drainage slope in the flexible hose.

13. The flexible plumbing system as set forth in claim **1** wherein the support means includes a first bracket that supports the first hose connection and a second bracket that supports the second hose connection for creating a drainage slope in the flexible hose.

14. The flexible plumbing system as set forth in claim **1** wherein the support means includes a bracket that supports at least one of the first and second hose connections at a substantially constant elevation relative to the movable cabin floor as the movable cabin moves between the extended and retracted positions.

15. The flexible plumbing system as set forth in claim **1** wherein the support means includes a bracket disposed to maintain the elevation of the second hose connection relative to the first hose connection so that the flexible hose forms a slope sufficient to allow material to drain in the desired direction when the movable cabin is positioned between the extended and retracted positions.

16. The flexible plumbing system as set forth in claim **1** including a guide engaging at least a portion of the flexible hose between the first and second hose connections to retain the flexible hose at a desired drainage angle as the movable cabin moves between the extended and retracted positions.

17. The flexible plumbing assembly as set forth in claim **16** wherein the guide includes a first guide member disposed near the first hose connection for receiving the flexible hose and retaining the flexible hose at the desired drainage angle.

18. The flexible plumbing assembly as set forth in claim **17** wherein the guide includes a second guide member disposed near the second hose connection for receiving the flexible hose and retaining the flexible hose at the desired drainage angle.

19. The flexible plumbing assembly as set forth in claim **1** wherein at least a portion of the flexible hose between the first and second hose connections is disposed within the wall structure of the fixed and movable cabins at a desired drainage angle as the movable cabin moves between the extended and retracted positions.

20. The flexible plumbing assembly as set forth in claim **19** wherein a plane passing through the first and second hose connections is substantially parallel to walls of the fixed and movable cabins.

21. The flexible plumbing assembly as set forth in claim **1** comprising sliding means for horizontally moving the second hose connection in the movable cabin at a constant elevation relative to the movable cabin floor as the movable cabin pipe moves with the movable cabin between the extended and retracted positions.

22. The flexible plumbing assembly as set forth in claim **21** wherein the support means comprises a bracket and the sliding means comprises a track operatively attached to a wall structure of the movable cabin for receiving the bracket wherein the track has inboard and outboard ends and the bracket is slidably attached to the track for movement between the inboard end when the movable cabin is in the retracted position and the outboard end when the movable cabin is in the extended position.

23. The flexible plumbing system as set forth in claim **1** comprising hose guiding means for holding at least a portion

of the flexible hose means for ensuring that material in the flexible hose moves in the desired direction as the movable cabin moves between the extended and retracted positions.

24. The flexible plumbing assembly as set forth in claim **23** wherein the hose guiding means comprises a fixed hose guide disposed near the first hose connection where the flexible hose runs generally horizontal and a movable hose guide disposed near the second hose connection where the flexible hose also runs generally horizontal, wherein both the fixed hose guide and the movable hose guide are adapted to hold the flexible hose so that material in the flexible hose flows in the proper direction.

25. The flexible plumbing assembly as set forth in claim **1** further comprising hose guiding means for holding at least a portion of the flexible hose at a desired drainage angle as the movable cabin moves between the extended and retracted positions.

26. The flexible plumbing assembly as set forth in claim **25** wherein said hose guiding means includes a fixed hose guide channel disposed near said fixed hose end, and a movable hose guide channel secured to move with said bracket near said movable hose end wherein portions of the hose lie respectively in the fixed hose guide channel and the movable hose guide channel at desired drainage angles.

27. The flexible plumbing assembly as set forth in claim **26** wherein said guide channels hold said hose in a generally U-shaped bend between said guide channels.

* * * * *

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United States Patent [19]

Walker

[11] **Patent Number: 5,988,221**

[45] **Date of Patent: Nov. 23, 1999**

[54] **DRAIN LINE EXTENDER FOR RECREATIONAL VEHICLES**

[76] Inventor: **Dewey W. Walker**, 1115 Russell St., Golden, Colo. 80401

[21] Appl. No.: **09/027,746**

[22] Filed: **Feb. 23, 1998**

[51] **Int. Cl.**[6] **F16K 3/00**

[52] **U.S. Cl.** **137/899**; 137/351; 137/615

[58] **Field of Search** 137/615, 899, 137/351

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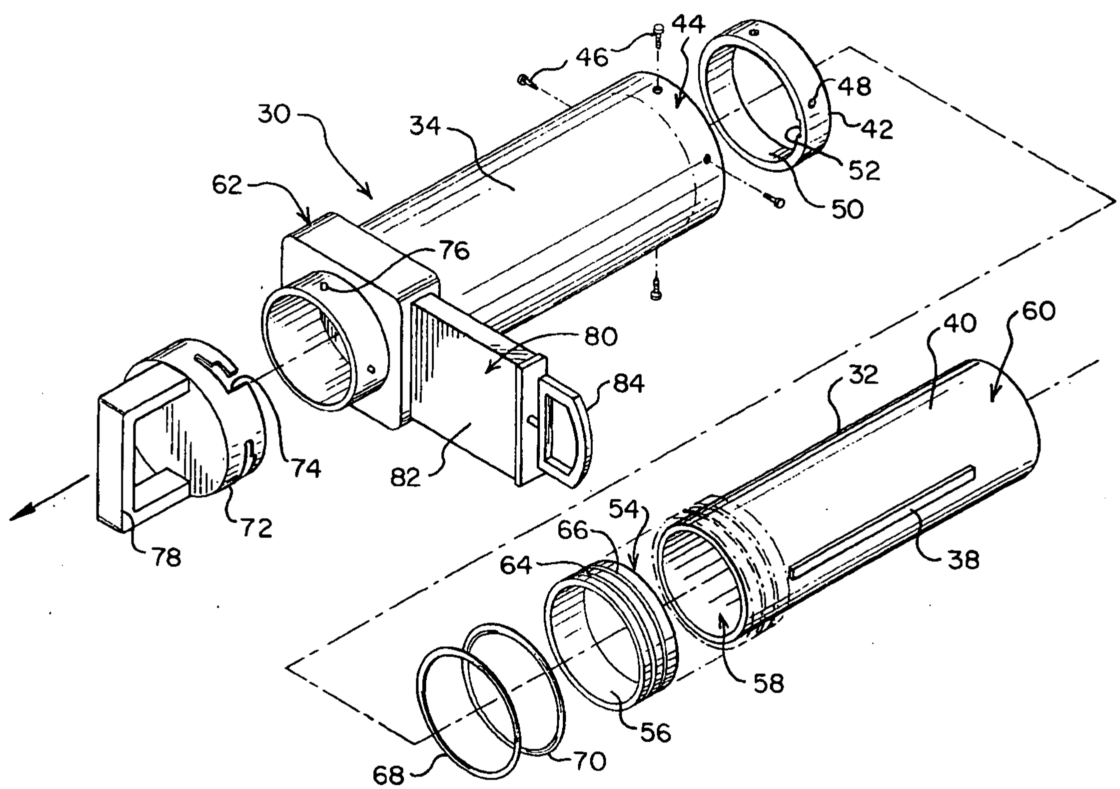
Primary Examiner—A. Michael Chambers
Attorney, Agent, or Firm—Donald W. Margolis; Emery L. Tracy

[57] **ABSTRACT**

A short drain line extender assembly is provided for use with waste holding tanks on recreational vehicles or the like in conjunction with a removable waste discharge conduit. The extender assembly includes first rigid short, rigid fluid conduit member communicating with a holding tank of a recreational vehicle. A second rigid short, rigid fluid conduit member is telescopically mounted to the first short, rigid fluid conduit member. The second conduit member includes a first movable end secured to the first conduit member and a second distal end adapted for telescoping movement outwardly from the first conduit member. Fluid sealing members are disposed between the first and second short, rigid fluid conduit members. A mechanism is provided for guiding the second short, rigid fluid conduit member longitudinally relative to the first short, rigid fluid conduit member and includes an arrangement for preventing rotational movement between the first and second short, rigid fluid conduit members as the second short, rigid fluid conduit member telescopically moves relative to the first short, rigid fluid conduit member. A device is disposed at the second short, rigid fluid conduit member's distal end for controlling the outflow of short, rigid fluid from the holding tanks through the short, rigid fluid conduit members. Finally, a mechanism is disposed at the distal end of the second short, rigid fluid conduit member for attaching a removable waste discharge conduit.

20 Claims, 3 Drawing Sheets



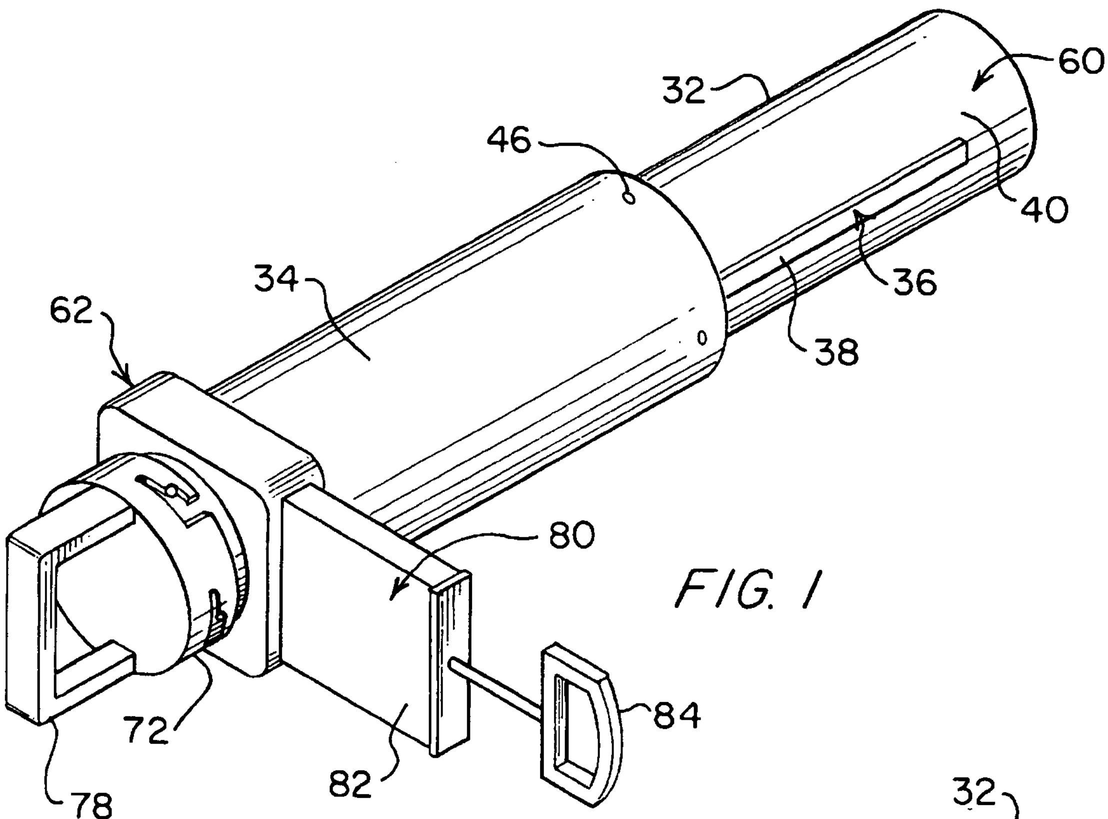


FIG. 1

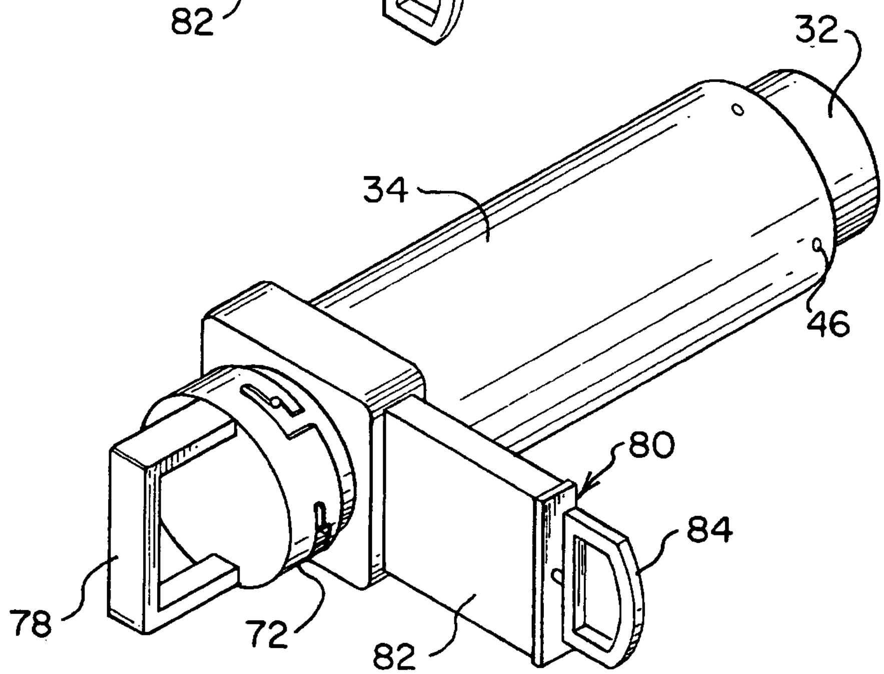


FIG. 2

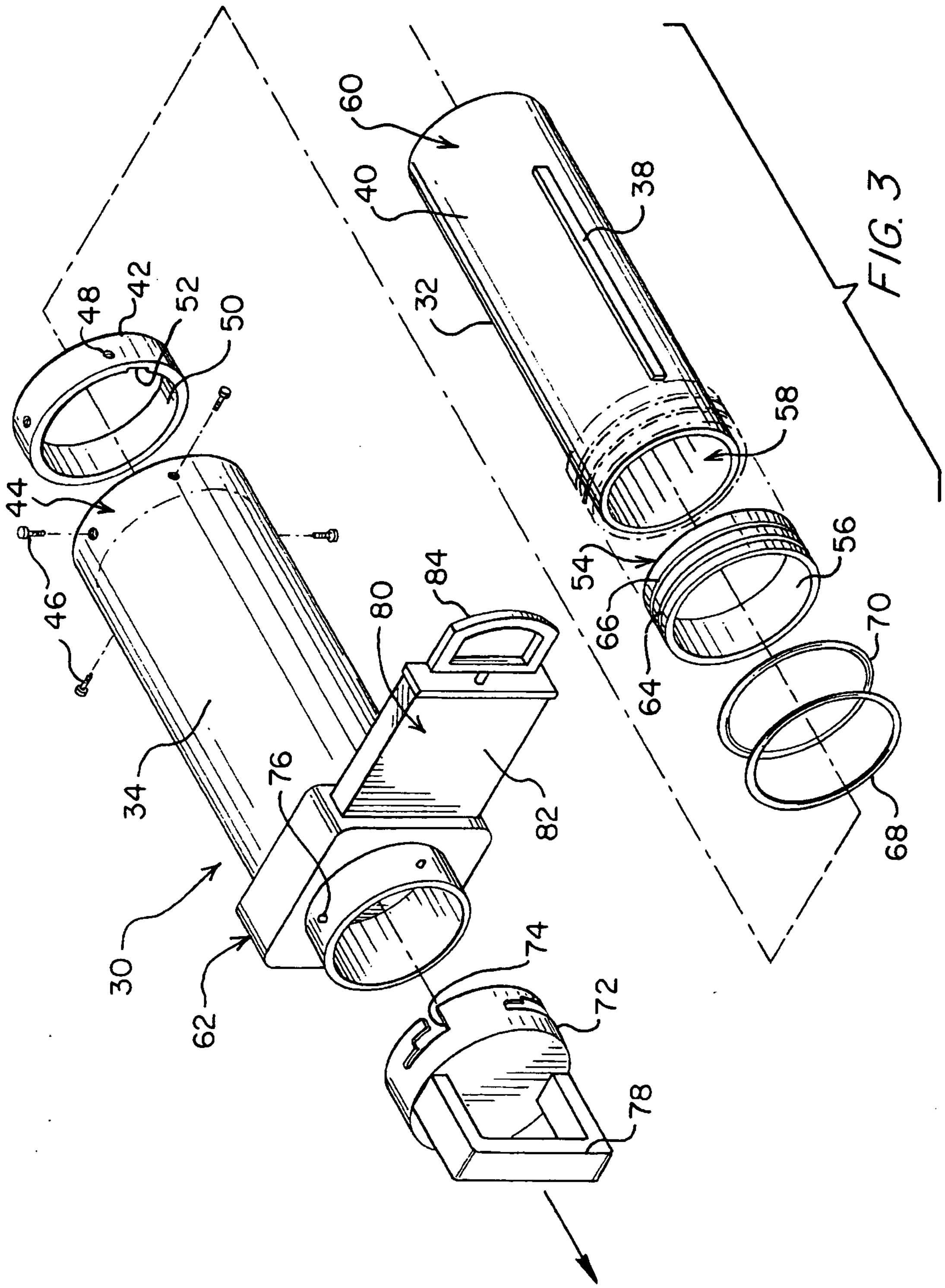

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FIG. 3

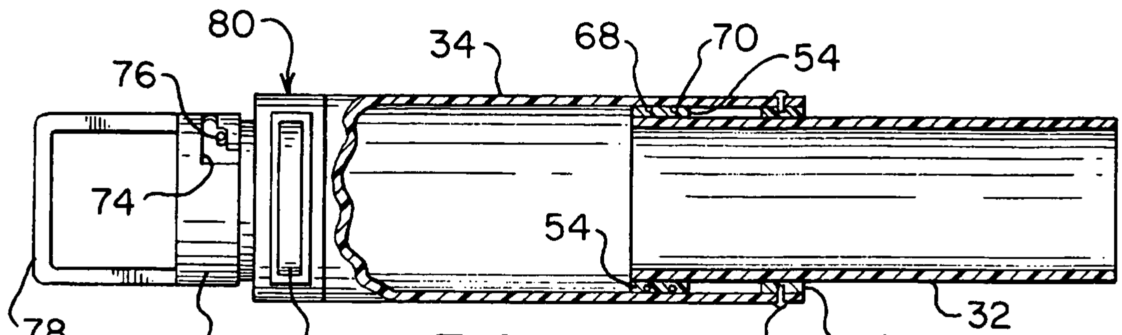

FIG. 4

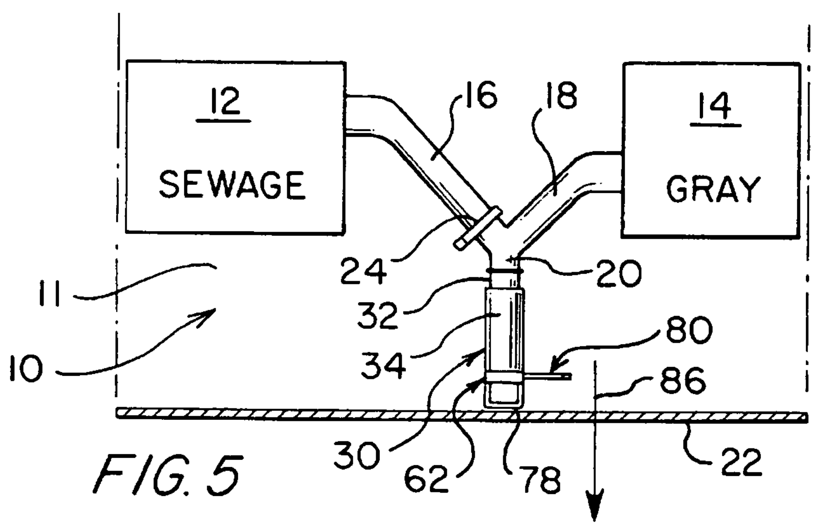

FIG. 5

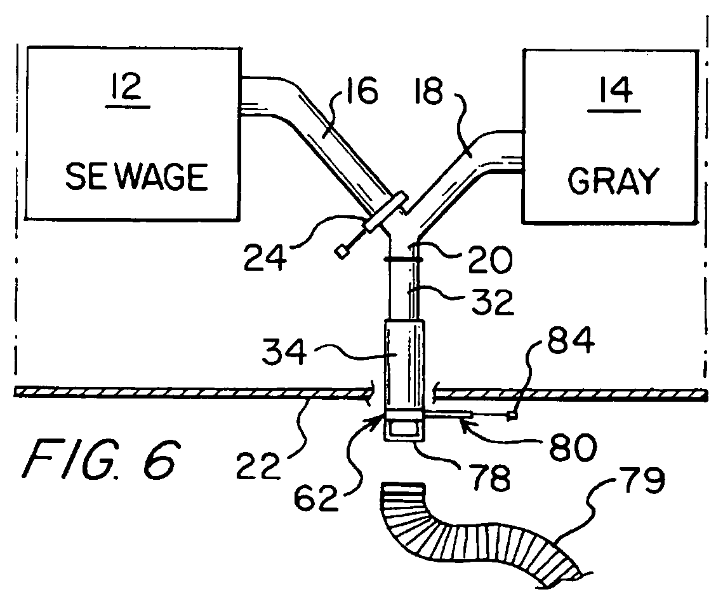

FIG. 6

DRAIN LINE EXTENDER FOR RECREATIONAL VEHICLES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to sewage discharge devices for recreational vehicles and, more particularly, to devices for extending the discharge device from the recreational vehicle holding tanks to a dump station site via a sewage hose or other conduit. Specifically, the present invention relates to a telescoping drain assembly extender mounted to the recreational vehicle to ease the attachment of a sewage hose or other conduit thereto.

2. Description of the Prior Art

Many types of vehicles, such as recreational vehicles, travel trailers, fifth wheelers, buses, trucks and the like have self-contained washing facilities and/or bathrooms. For ease of style these vehicles will be herein collectively referred to as "recreational vehicles" or "RVs". Such RVs include systems which store sewage/waste water until those materials can be properly disposed of. All of these types of RV,s generally utilize the same means of conducting waste to external storage tanks, dumps, or processing systems, such as those which are used in RV parks, truck/bus stops and the like. Conventional RV vehicles generally have two holding tanks, a sewage tank for receiving fluid sewage from the toilet system, and a gray water tank for receiving waste water, such as from the kitchen, bathroom sinks and shower. These two holding tanks each have a which interconnect to form a single liquid conduit drain line or drain pipe. RVs generally have an easily accessible external cabinet or storage facility which stores a length of flexible sewage discharge hose or other conduit. This discharge hose or other conduit may be manually connected to a fitting on the outlet stub of the drain pipe. The other end of the hose or other conduit is then extended to a dump fitting. Similarly, when the RV is preparing to move on, it is also necessary to handle the hose or other conduit and flush the waste from it before storing it. These processes, i.e., dumping the waste from the holding tank into the inlet receptacle of the RV dump station and disconnecting and storing the hose or other conduit, are the messiest and most dreaded aspects of using an RV. The state-of-the-art system is, at best, somewhat clumsy.

Besides the mess, the predominate problem with the traditional sewage hose or other conduit systems, in that the RV user must get on his or her knees and reach beneath the RV to attach the sewage hose or other conduit to the outlet pipe of the conduit beneath the RV. Consequently, there have been numerous devices which have been developed to increase the ease and/or reduce the clumsiness of attaching and detaching RV sewage hoses or other conduits. U.S. Pat. Nos. 4,133,347; 4,223,702; 4,845,349 and 5,023,959 all disclose systems whereby the flexible discharge hoses are stored in a conduit extension member beneath the RV, and are telescopically moved therefrom when it is desired to secure the hose to a dump site. While these systems have their merits, these devices are stored permanently beneath the RV, and they still generally require the RV user to get on his or her knees to reach beneath the RV to access the sewage hose.

U.S. Pat. Nos. 2,915,081; 3,496,959 and 4,779,650 all disclose telescopic drain pipes that are intended for permanent mounting beneath the RV and for a lengthy extension, i.e. many feet, from the RV directly to the dump site. While this certainly eliminates the need for securing a separate sewage hose or other conduit to the outlet pipe, such long

fixed telescopic devices must be stowed beneath the RV. Thus, a user must still reach beneath the RV to access these devices. Moreover, such an excessive length of drain pipes positioned beneath an RV lends itself to potential damage during movement of the RV over the road, from bumps, dips, rocks and the like.

U.S. Pat. Nos. 3,623,500; 4,650,224; 4,844,121 and 5,323,813 all disclose devices which are solid members stored separately within an RV and are for use in conjunction with a flexible RV hose or other conduit. These devices are intended to help support the hose or other conduit in its extension from the RV to the dump site in a variety of manners. Moreover, these devices must be separately stored like the RV sewage hose or other conduit. In addition, the user of such devices must nonetheless get on his or her knees to reach beneath the RV to secure the flexible sewage hose or other conduit.

Finally, U.S. Pat. Nos. 4,554,949 and 5,141,017 disclose devices that are designed to assist in securing and/or cleaning flexible sewage hoses for RVs.

In all of the above described systems for emptying the liquid storage tanks of an RV, an RV user must still generally get on his or her knees and reach beneath an RV in order to access the RV sewage system. This process can be very cumbersome, difficult and uncomfortable at times, particularly if one is attempting to set up an RV in the dark or during inclement weather. It would be much easier to be able to access the conduit outlet from the holding tanks if such outlet were located exterior to the RV. However, this cannot be done inasmuch as such members would project beyond the side of the RV and pose a significant hazard to other vehicles and fixed objects during travel. Thus, there is still a need for a device which will eliminate the need for an RV and user to have to get on his or her knees and reach beneath an RV in order to access and hook up a sewage discharge hose or other conduit.

SUMMARY OF THE INVENTION

Therefore, it is one object of the present invention to provide a short extender assembly for an RV waste holding tank drain line.

It is another object of the present invention to provide a system for a short extender assembly for an RV waste holding tank drain line, which system will eliminate the necessity for an RV user to bend beneath an RV in order to access the sewage discharge system of the RV.

It is still another object of the present invention to provide a device which will enable an RV user to access the sewage discharge system from outside the RV without creating dangerous obstacles or undue piping structure either beneath or extending from the side of the RV.

To achieve the foregoing and other objects and in accordance with the purpose of the present invention, as embodied and broadly described herein, a short drain line extender assembly is provided for use with waste holding tanks on recreational vehicles or the like in conjunction with a removable waste discharge conduit, such as a hose. The extender assembly includes a first short, rigid fluid conduit member communicating with the drain pipe from the holding tanks of a recreational vehicle. A second short, rigid fluid conduit member is telescopically mounted with respect to the first short, rigid fluid conduit member. The second conduit member includes a first proximate movable end secured to the first conduit member and a second distal end adapted for telescoping movement outwardly from the first conduit member. A fluid sealing member is provided

between the first and second short short, rigid fluid conduit members. In preferred embodiments, a mechanism is provided for guiding the second short, rigid fluid conduit member longitudinally relative to the first short, rigid fluid conduit member, and also includes a device for preventing rotational movement between the first and second short, rigid fluid conduit members as the second short, rigid fluid conduit member moves telescopically relative to the first short, rigid fluid conduit member. Another device is also disposed at the distal end of the second short, rigid fluid conduit member for controlling the outflow of fluid from the holding tanks of the RV through the conduit member. Finally, a mechanism is disposed at the second short, rigid fluid conduit member distal end for attaching a removable waste sewage discharge hose or other conduit.

As used herein, the term "short" first means short enough to allow the combined first and second rigid fluid conduits to reside entirely beneath the RV when they are in their collapsed position, and not long enough to reach to a dump station site when they are in their fully extended position. More specifically, and based on the location of the drain line from the holding tanks of most Rvs, the short, rigid conduits need seldom to exceed a maximum of 12 inches nor a minimum of 4 inches. In preferred embodiments, in which a handle is connected to the movable/second short rigid fluid conduit, the length of the short, rigid conduits may be such as to position the handle either substantially flush with the side of the RV, or say up to within about 5 or 6 inches inside of the side of the RV, but at a location which is easily within arm's reach for grasping by an RV user by simply bending over or squatting in a vertical position, but without the need to get on his or her knees, as is required by current state-of-the-art systems. Furthermore, the short drain line extender assembly of the present invention is preferably sized to provide between about a 4 inch to about a 12 inch extension, with not more than about 12 inches of travel for the second conduit as it is extended. Concomitantly, the first and second short, rigid fluid conduits need not be more than about 4 inches to about 12 inches in length. Lengths in excess of 12 inches, if not needed to extend the short drain line extender assembly to the edge of the RV, or slightly beyond, would contribute too much weight and vibration to the assembly when it is in its collapsed position, and too much torque to the system when it is in its fully extended position. Such excessive weight would also provide undue strain at the junctions of piping and possibly develop long term problems. Moreover, less than 4 inches will not provide enough travel to easily position the end of the system at or outside of the side the standard RV when it is in the extended position. While extension lengths of less than 4 inches or more than 12 inches may be used, it appears that about 6 inches of extension is optimum for the standard RV. Moreover, when the short drain line extender assembly of the present invention is designed within the length specifications indicated above, it is easily stored underneath the RV without providing exterior projections or excessive piping beneath the RV, and is readily pulled out to provide easy access for hose hookup.

These and other objects of the present invention will become apparent to those skilled in the art from the following detailed description, showing the contemplated novel construction, combination, and elements as herein described, and more particularly defined by the appended claims, it being understood that changes in the precise embodiments to the herein disclosed invention are meant to be included as coming within the scope of the claims, except insofar as they may be precluded by the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate complete preferred embodiments of the present invention according to the best modes presently devised for the practical application of the principles thereof, and in which:

FIG. **1** is an upper front perspective view illustrating the short drain line extender assembly constructed in accordance with the present invention in a telescopically extended position, and with the fluid flow control valve open, and the drain end closed;

FIG. **2** is an upper front perspective view illustrating the short drain line extender assembly similar to that of FIG. **1**, but illustrating the extender assembly in its collapsed position, and with the fluid flow control valve closed, and the drain end also closed;

FIG. **3** is an upper front, partially exploded perspective view of the short drain line extender assembly of FIG. **2**, but with the drain end open;

FIG. **4** is a side view, partially in cross-section, of the short drain line extender assembly of the present invention in a partially telescopically extended position;

FIG. **5** is a bottom schematic view of a typical sewage system of a recreational vehicle, partially in cross-section, with the short drain line extender assembly of the present invention secured thereto in its closed position; and

FIG. **6** is a view similar to that of FIG. **5** but illustrating the extender assembly of the present invention in its telescopically extended and open position

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. **5** and **6**, a partial recreational vehicle, generally **10**, having a bottom **11** is shown as including a sewage holding tank **12** for receiving refuse from toilets, not shown, and a gray water holding tank **14** for receiving liquid waste from showers and sinks, also not shown. Each holding tank **12** and **14** has a drain line **16**, **18**, respectively, that extends therefrom, and these are shown as merging into a single drain pipe or conduit **20**.

In the typical prior art designs, the drain pipe **20** extends toward the side **22** of the RV **10**. At the end of this fluid drain pipe **20** is usually located a connecting member, typically a bayonet-type connector, which is available for attachment to a separately stowed flexible sewage or waste discharge hose or other conduit. This discharge hose or other conduit would then extend from the drain pipe **20** to a dump hole or site at an RV park or the like, not shown. A fluid control lever is typically found at the end of the drain pipe **20** which would open or close off the drain pipe **20** for fluid flow therethrough from the tanks **12** and **14**. As is illustrated in FIGS. **5** and **6**, a separate fluid control slide valve **24**, which is now a sanitary requirement for all new RVs being built, is located on the drain line **16** from the sewage tank **12**.

In lieu of the prior art approach described above, in the present invention, a short extender mechanism **30** is secured to the end of the drain pipe conduit **20**. This short extender mechanism **30** may be installed as original equipment during RV manufacturing wherein the short extender mechanism **30** is an integral part of the drain pipe **20**, or for existing RVs, may be installed as a retrofit system.

Referring now particularly to FIGS. **1–4**, the drain line short extender device **30** of the present invention includes a first short short, rigid fluid conduit member or pipe **32** which is either an integral part of the outlet drain pipe **20** or is secured thereto by any acceptable means known to the art.

Where the first conduit pipe 32 is an integral part of the outlet drain pipe 20, it is typically the same circumference as drain pipe 20, although conduit pipe 32 may be of any circumference which can be effectively joined to drain pipe 20. A second short short, rigid fluid conduit member 34 is mounted to the first short conduit 32 for telescoping movement there along. While the preferred embodiment of the present invention is illustrated wherein the second short conduit or pipe 34 has a diameter larger than the first conduit 32 and is thus adapted to telescopically move in a sliding fashion over the outer surface of the pipe 32, it should be understood that the second conduit 34 may have a outer diameter less than the inner diameter of the pipe 32 and thus be adapted to slide in and out of the interior of the pipe 32.

In the preferred embodiment, the first conduit 32 is a pipe having a three inch inner diameter, and the second conduit 34 has a 4 inch inner diameter which is sized to snugly and slidingly receive the first pipe 32 there within. Conduits 32 and 34 may be constructed of any material, including metal or ceramic, but in its preferred embodiment is constructed of plastic, such as ABS or PVC. In the preferred form shown, a guide mechanism 36 is provided for guiding the longitudinal movement of the second conduit 34 along the first conduit 32 as well as for preventing rotational movement between the two units, 32, 34. In the preferred form shown, the guide mechanism 36 is in the form of a longitudinal rib 38 and is disposed along the outer surface 40 of the first conduit 32. It should be understood that more than one rib guide 38 may be provided along the first conduit 32.

A retention ring 42 is positioned within the inside surface of the second conduit 34 at the first or proximate end 44 thereof. The retainer ring 42 does fit snugly within the end 44 of the conduit 34 and is preferably secured thereto by a plurality of screws or other attachment members 46 which pass through apertures through second conduit 34 and apertures 48 of the ring 42. It should be understood, however, that the ring 42 may be secured to the inside portion of the end 44 in any manner, such as by glue or other known attachment expedients.

The inner surface 50 of the ring 42 includes a notch 52 which forms a channel for receiving the rib 38. As a result, rib 38 may pass longitudinally through notch 52 so as to permit conduit 32 to slidingly move in a guided, nonrotational manner within second conduit 34. Guide mechanism 32 functions as a mechanism for preventing rotation between the conduit components 32 and 34 inasmuch as the notch 52 is sized to snugly receive rib 38. This tongue and groove arrangement prevents relative rotation between the rib 38 with attached conduit 32 and the ring 42 with attached conduit 34. It should be understood, however, that any other type of guide mechanism may be utilized that allows longitudinal movement of the second conduit 34 along the first conduit 32 in such a manner so as to prevent relative rotation therebetween.

A sealing mechanism 54 is provided between the first conduit 32 and the second conduit 34 so as to prevent leakage of fluid which passes through the combined conduit members 32 and 34. In its preferred form, the sealing mechanism 54 is in the form of a ring member 56 which is secured to the exterior surface 40 of the first conduit member 32 at the second or distal end 58 thereof. Thus, the first conduit 32 has a first or proximate end 60 which is adapted for attachment to the drain pipe 20 and a second or distal end 58, while the second conduit 34 likewise has a first or proximate end 44 and a second or distal end 62. Ring 56 is in the form of a bushing which includes a pair of circumferential grooves 64, 66, which are sized and shaped to receive, respectively, a pair of O-rings 68, 70. In its preferred form, the components of ring 56 are secured about the end 58 by solvent bond, glue or other attachment means.

Ring 56, in addition to serving as a seal between the first conduit 32 and the second conduit 34, also serves as a stop. This is accomplished due to the fact that ring 56 abuts the ring 50 of the second conduit 34, as the second conduit 34 is pulled out to its fully extended position. As a result, this abutment between the ring 54 and the ring 42 defines the maximum extent to which the second short, rigid fluid conduit 34 may be extended relative to the first conduit 32. This can be clearly seen and is illustrated in FIGS. 1, 2, 4, and 6, wherein FIGS. 2 and 5 illustrate the second conduit 34 in its fully collapsed or stored state while FIGS. 1 and 6 illustrate the second conduit 34 in its fully extended state.

The distal end 62 of the second conduit 34 is adapted for connection to a flexible sewage hose 79 or other conduit, as is typical in the art, or a cap 72, which is also typical in the prior art. In preferred fashion, the cap 72 includes a plurality of L-shaped slots 74 which interact with a plurality of pins 76 disposed about the distal end 62, which is known as a bayonet-type coupling. This bayonet-type coupling mechanism is common in recreational vehicles drain systems. Within the present invention, however, the cap 72 includes a handle 78 extending from it. Thus, when the cap 72 with the handle 78 is attached to the distal end 62 of the second conduit 34, the handle 78 serves to enable an RV owner or user to physically pull the second short, rigid fluid conduit 34 so that it extends longitudinally outwardly along the first conduit 32. Also disposed at the distal end 62 of the second conduit 34 is a fluid control valve 80 in the form of a slide control 82 having a handle 84 for opening or closing the same. This type of short, rigid fluid control valve 80 is also well known to the art. When it is desired to open the unit 30 for fluid flow, the handle 84 is pulled laterally away from the slide control member 82 as illustrated in FIG. 1, thereby moving an art known internal slide, not shown, away from the opening of the conduit 34 thereby allowing fluid to flow out of conduit 34. If it is desired to close the valve 80, then the handle 84 is pressed inwardly toward the slide control 82 to thereby move a slide (not illustrated) within the member 80 to close off the opening at the end of the conduit 34.

Thus, the present invention enables an RV user to store the short extender device 30 in its closed position as illustrated in FIG. 5 during travel. When the RV user pulls into an RV park or other dump area and desires to hook up its sewage hose or other conduit to the dump site, the user simply pulls the handle 78 laterally outwardly along the direction 86 so as to extend the second short, rigid fluid conduit member 34 laterally outwardly beyond the side 22 of the RV 10. Once this is accomplished, the handle 78 and cap 72 are rotated so as to disengage the cap 72 from the distal end 62 of the second conduit 34, and a sewage hose 79 or other conduit is then connected to the bayonet-pins 76 in a typical bayonet-type coupling well known in the art. The significant advantage of the present invention is that the distal end 62 of the unit 30 is now positioned outwardly beyond the side 22 of the RV, which provides easy access for sewage hose or other conduit coupling and uncoupling. Thus, the owner or user of the RV 10 does not have to get on his or her knees and bend over under the RV 10 in order to access the end of the drain pipe 20 as in the prior art RV designs. The handle 78 permits the user to simply bend over and easily pull the second conduit 34 away from the first conduit 32 in the direction of the arrow 86 until the unit 30 is in its open position. Once the RV hose or other conduit has been hooked to the distal end 62, the slide handle 84 is opened to allow fluid to flow

from the tanks **12** and **14**. The sewage control member **24** is optionally left open or closed at the discretion of the RV user. Even if the control valve **24** is left open, the control valve **80** easily controls the fluid outflow from the tanks **12** and **14**.

Once an RV owner is ready to move from an RV site, the handle **84** is closed and the hose or other conduit **79** disconnected. At this point, the cap **72** with the handle **78** is twisted back onto the bayonet-pins **76**, and the handle **78** is then used to push the second short, rigid fluid conduit **34** longitudinally back onto the first conduit **32** in the direction opposite that of the arrow **86** until the unit **30** is in its fully closed and stored position as illustrated in FIG. **5**.

As can be seen from the above, the present invention provides a simple, but unique design to permit an RV owner to use a standard flexible sewage hose or other conduit without having to go through the fuss and mess of having to crawl underneath the recreational vehicle in order to attach the same to the RV's fluid discharge system The present invention may be adapted as original equipment on an RV, or it may be retro-fitted by simply securing the proximate end **60** of the first conduit member **32** onto the drain pipe **20** at a position such that when the device **30** is in its closed and stored position, it is located fully beneath the bottom **11** of the RV **10**. The present invention does not add any significant piping underneath the RV, thereby avoiding problems resulting from bottoming out, road debris and the like. Moreover, the present invention does not provide any projections beyond the side **22** during travel of the recreational vehicle **10**, which projections would be inherently dangerous. In fact, the handle **78** may be positioned up to within about 5 inches inside of the RV side **22** and still be easily within an arm's reach of an RV user by simply bending over, as opposed to getting on their hands and knees. The device **30** of the present invention is preferably sized and shaped to provide a six inch extension with a minimum of 4 inches and a maximum of 12 inches. More than 12 inches of travel for the second conduit **34** would provide too much weight when the device **30** is in its fully extended position. Such excessive weight would provide undue strain at the junctions of piping and possibly develop long term problems. Moreover, less than 4 inches will not provide enough travel to easily position the distal end **62** well outside the side **22** of the RV **10** in the extended position. However, when the present invention **30** is designed within the specifications indicated above, it is easily stored underneath the RV without providing exterior projections or excessive piping beneath the RV, and is readily pulled out to provide easy access to the distal end **62** for hose or other conduit hookup. Removal of the hose or other conduit allows one to simply return the cap **72** and then use the handle **78** to push the unit back into a stored position, as previously described. Thus, the present invention is easy to use, inexpensive to construct, yet provides significant advantages over prior art designs.

It is therefore seen that the present invention provides a short extender assembly for an RV waste holding tank drain line which system eliminates the necessity for an RV user to bend or kneel beneath an RV in order to access the sewage discharge system of the RV. Furthermore, the assembly enables an RV user to access the sewage discharge system from outside The RV without creating dangerous obstacles or undue piping structure either beneath or extending from the side of the RV.

The foregoing description and the illustrative embodiments of the present invention have been described in detail in varying modifications and alternate embodiments. It should be understood, however, that the foregoing description of the present invention is exemplary only, in that the scope of the present invention is to be limited to the claims as interpreted in view of the prior art. Moreover, the invention and illustratively disclosed herein suitably may be practiced in the absence of any element which is not specifically disclosed herein.

I claim:

1. A short drain line extender assembly for connection with a waste holding tank drain line on a recreational vehicle, which normally requires a removable waste discharge conduit to reach to a dump site, said short drain line extender assembly comprising:
   - a first short, rigid fluid conduit member for connection with a liquid holding tanks drain line of a recreational vehicle said first short, rigid fluid conduit member having an inner and outer surface and adapted for positioning in a stored position substantially completely beneath a recreational vehicle;
   - a second short, rigid fluid conduit member having an inner and outer surface, and telescopically connected to said first short, rigid fluid conduit member, said second short, rigid conduit member including a first movable end slidingly secured to said first short, rigid conduit member, and having a second distal end adapted for continuous movement between a first operating position outwardly from said first short, rigid conduit member and a second inward stored position in substantial registration with said first short, rigid conduit member substantially completely beneath a recreational vehicle, wherein said second short, rigid fluid conduit member when moved telescopically relative to said first fluid short, rigid fluid conduit member from said stored position substantially completely beneath a recreational vehicle to said operating position is disposed laterally outwardly up to or slightly beyond the side of such a recreational vehicle, but not normally to a dump site;
   - fluid sealing means between said first and second short, rigid fluid conduit members; and
   - means disposed at said second short, rigid fluid conduit member distal end for attaching a removable waste discharge conduit in order to normally reach to a dump site.

2. The assembly as claimed in claim **1**, wherein said second short, rigid fluid conduit member is sized and shaped to surround said first short, rigid fluid conduit member.

3. The assembly as claimed in claim **1**, wherein said first and second short, rigid fluid conduit members are each cylindrical in shape and concentric to one another.

4. The assembly as claimed in claim **1**, wherein said fluid sealing means comprises a sealing member disposed circumferentially about the outer end of said first short, rigid fluid conduit member, and which sealing means engages said inner surface of said second short, rigid fluid conduit member.

5. The assembly as claimed in claim **4**, wherein said sealing member includes at least one O-ring for fluid sealing between said conduit members.

6. The assembly as claimed in claim **1**, wherein said assembly includes means for guiding said second short, rigid fluid conduit member longitudinally relative to said first short, rigid fluid conduit member and including means for preventing rotational movement between said first and second fluid conduit members as said second short, rigid fluid conduit member moves telescopically relative to said first short, rigid fluid conduit member, and wherein further, said guide means comprises at least one projection member

disposed along the outer surface of one of said short, rigid fluid conduit members, and at least one channel member disposed on the inner surface of said other short, rigid fluid conduit member, said charnel being adapted for engagement with said projection member.

7. The assembly as claimed in claim **6**, wherein said rotational movement prevention means comprises said projection member being in the form of a longitudinal rib, and said channel being in the form of a groove sized and shaped to snugly, but slidingly receive and move along said rib.

8. The assembly as claimed in claim **1**, wherein said discharge conduit attachment means comprises a portion of a bayonet-type coupling.

9. The assembly as claimed in claim **1**, wherein said assembly further includes a handle member removably attachable to said discharge conduit attachment means, said handle member being adapted for grasping and pulling for actuating the telescopic movement of said second short, rigid fluid conduit member relative to said first short, rigid fluid conduit member out from its stored position beneath a recreational vehicle.

10. In a short, rigid fluid control system for a recreational vehicle including gray water and sewage storage tanks, drain lines exiting from each said storage tank, a short, rigid fluid conduit disposed beneath said recreational vehicle and communicating with said drain lines, a flexible, removable waste discharge conduit for extending from said short, rigid fluid conduit to a dump site, and means for releasably interconnecting said discharge conduit to the distal end of said short, rigid fluid conduit, the improvement wherein said short, rigid fluid conduit comprises a first conduit member disposed beneath the recreational vehicle and having a proximate end connected to said drain lines and a distal end extending toward the side of the recreational vehicle, a second conduit member telescopically mounted to said first conduit member for movement between a closed position beneath the recreational vehicle and an extended position wherein the distal end of said second conduit member projects outwardly from beneath and beyond the side of the recreational vehicle, means for guiding said second conduit member longitudinally relative to said first conduit member including means for preventing rotational movement between said first and second conduit members, and means disposed proximate the distal end of said second conduit member for controlling the outflow of fluid from said tanks through said short, rigid fluid conduit and said removable flexible discharge conduit.

11. The improvement of claim **10**, wherein said discharge conduit interconnection means is disposed at the distal end of said second short, rigid fluid conduit member, and wherein said improvement further includes a handle member adapted for releasable attachment to said discharge conduit interconnection means for enabling telescopic movement of said second conduit member relative to said first conduit member.

12. The improvement of claim **10**, wherein said second conduit member is sized and shaped to surround said first conduit member, and wherein said improvement further includes sealing means disposed between said first and second conduit members, and wherein said sealing means comprises a sealing ring disposed about the distal end of said first conduit member in communication with the inner surface of said second conduit member.

13. The improvement of claim **12**, wherein the proximate end of said second rigid, short fluid conduit member includes an interior sealing ring adapted to abut said sealing means to define the maximum extent of telescopic extension of said second rigid, short fluid conduit member along said first rigid, short fluid conduit member, said interior sealing ring including a groove disposed therein to form a said channel to slidingly receive said projection member.

14. A sewage discharge apparatus for recreational vehicles or the like containing waste holding tanks and utilizing a waste discharge conduit releasably connectable to a fluid waste line communicating with said holding tanks, said apparatus comprising:

- a first short, rigid fluid conduit having first and second ends and adapted for fluid connection with said holding tanks;
- a second short, rigid fluid conduit having first and second ends and mounted about said first short, rigid fluid conduit for telescopic movement between a closed position wherein the first and second ends of both said short, rigid fluid conduits are aligned proximate each other, and an open extended position wherein the first end of said second short, rigid fluid conduit is proximate the second end of said first short, rigid fluid conduit;
- fluid sealing means disposed between said first and second short, rigid fluid conduits;
- means for guiding the longitudinal movement of said second short, rigid fluid conduit along said first short, rigid fluid conduit while preventing rotation between said first and second short, rigid fluid conduits;
- means disposed proximate said second end of said second short, rigid fluid conduit for controlling the outflow of fluid through said first and second short, rigid fluid conduits; and
- means disposed at the second end of said second short, rigid fluid conduit for selectively attaching a waste discharge conduit.

15. The apparatus as claimed in claim **14**, wherein said guide means comprises at least one elongated rib disposed along the outer surface of said first short, rigid fluid conduit, and an interior ring disposed along the inner surface of second short, rigid fluid conduit proximate the first end thereof, said interior ring including a groove notched therein to receive said rib for sliding movement therethrough while preventing relative rotation between said first and second short, rigid fluid conduits.

16. The apparatus as claimed in claim **15**, wherein said sealing means comprises a ring member disposed along the outer surface of said first short, rigid fluid conduit proximate the second end thereof sized to sealingly engage the inner surface of said second short, rigid fluid conduit and to abut the interior ring of said second short, rigid fluid conduit to define the maximum telescopic extension of said second short, rigid fluid conduit relative to said first short, rigid fluid conduit.

17. The apparatus as claimed in claim **16**, wherein said sealing ring includes at least two O-rings.

18. The apparatus as claimed in claim **16**, wherein said apparatus further includes a handle including means to selectively interact with said conduit attachment means to enable manual operation of the telescopic movement of said second short, rigid fluid conduit relative to said first short, rigid fluid conduit.

19. The apparatus as claimed in claim **16**, wherein said second short, rigid fluid conduit telescopically extends between 4 to 12 inches beyond second end of said first short, rigid fluid conduit.

20. A short drain line extender assembly for connection with a waste holding tank drain line on a recreational vehicle

in conjunction with a removable waste discharge conduit, said short drain line extender assembly comprising:

a first short, rigid fluid conduit member for connection with a liquid holding tank drain line of a recreational vehicle said first short, rigid fluid conduit member having an inner and outer surface;

a second short, rigid fluid conduit member having an inner and outer surface, and telescopically connected to said first short, rigid fluid conduit member, said second short, rigid conduit member including a first movable end slidingly secured to said first short, rigid conduit member, and having a second distal end adapted for continuous movement between a first position outwardly from said first short, rigid conduit member and a second inward position in substantial registration with said first short, rigid conduit member;

means for guiding said second short, rigid fluid conduit member longitudinally relative to said first short, rigid fluid conduit member and including means for preventing rotational movement between said first and second fluid conduit members as said second short, rigid fluid conduit member moves telescopically relative to said first short, rigid fluid conduit member, and wherein further, said guide means comprises at least one projection member disposed along the outer surface of one of said short, rigid fluid conduit members, and at least one channel member disposed on the inner surface of said other short, rigid fluid conduit member, said channel being adapted for engagement with said projection member;

fluid sealing means between said first and second short, rigid fluid conduit members; and

means disposed at said second short, rigid fluid conduit member distal end for attaching a removable waste discharge conduit to provide for the outflow of fluid to a dump site.

* * * * *

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United States Patent [19]

Akedo et al.

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[45] **Date of Patent: Feb. 15, 2000**

[54] **FLEXIBLE HOSE**

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[52] **U.S. Cl.** **138/129**; 138/122; 138/132; 138/144; 138/153; 138/154

[58] **Field of Search** 138/129, 124, 138/125, 132, 144, 153, 154, 122

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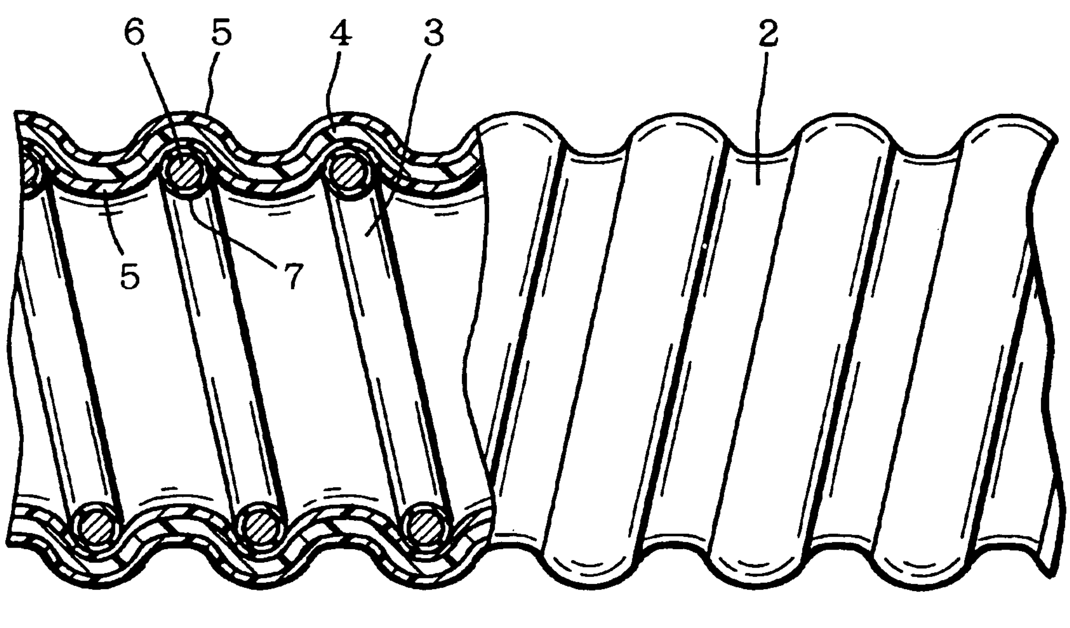
Primary Examiner—James Hook
Attorney, Agent, or Firm—Pillsbury Madison & Sutro LLP

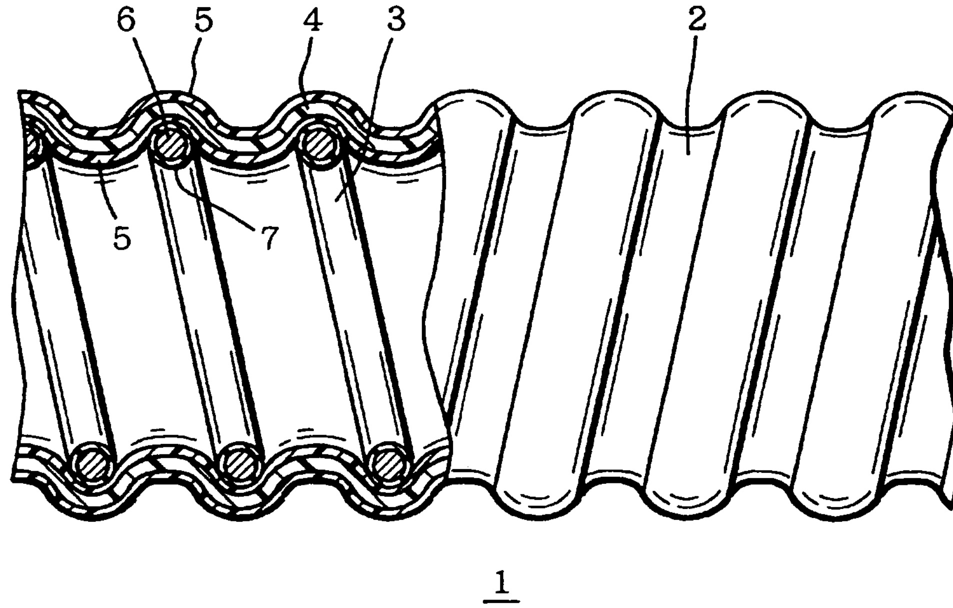
[57] **ABSTRACT**

A laminated tape comprising a main layer of a polyester-series thermoplastic polyurethane resin and a covering layer formed of a soft vinyl chloride resin fused with at least one surface of the main layer is spirally wound, and its adjacent side edges are bonded each other to form a hose wall. The shrinkage ratio of the length of the hose in an unloaded condition is 25% or less relative to the original length of the hose as determined by measuring the original length and the length of the hose after the test which comprises subjecting the hose compressed in a longitudinal direction to ten heating/cooling-cycles successively, one cycle comprising a heating step for exposing the compressed hose to an atmosphere of 70° C. for two hours and a cooling step for cooling the heat-treated hose at an atmosphere of −20° C. for two hours, followed by returning the temperature of the hose to an ordinary or room temperature and allowing the hose to stand for one hour. According to the present invention, the drawbacks such as the strong inclination to shrink and the great pressure loss are improved, and the degradation of various physical properties by ultraviolet ray and hydrorization is prevented.

5 Claims, 3 Drawing Sheets



F I G. 1



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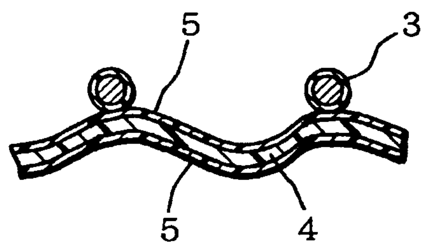


F I G. 2B

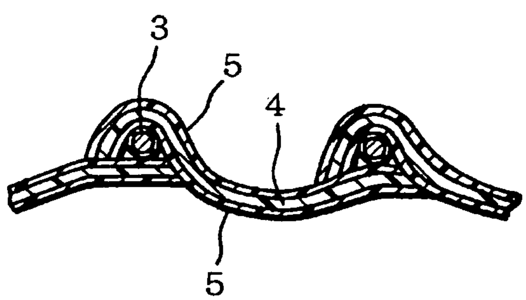


FIG. 3A

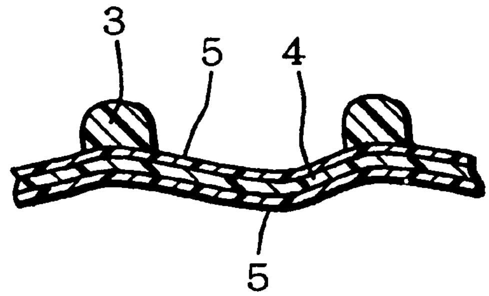


FIG. 3B

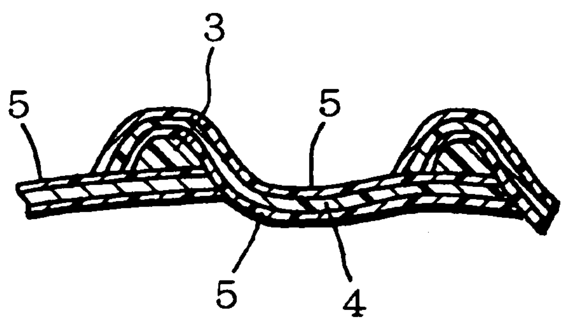


FIG. 4

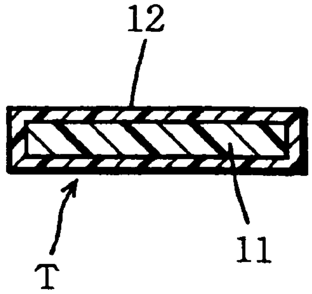


FIG. 5A

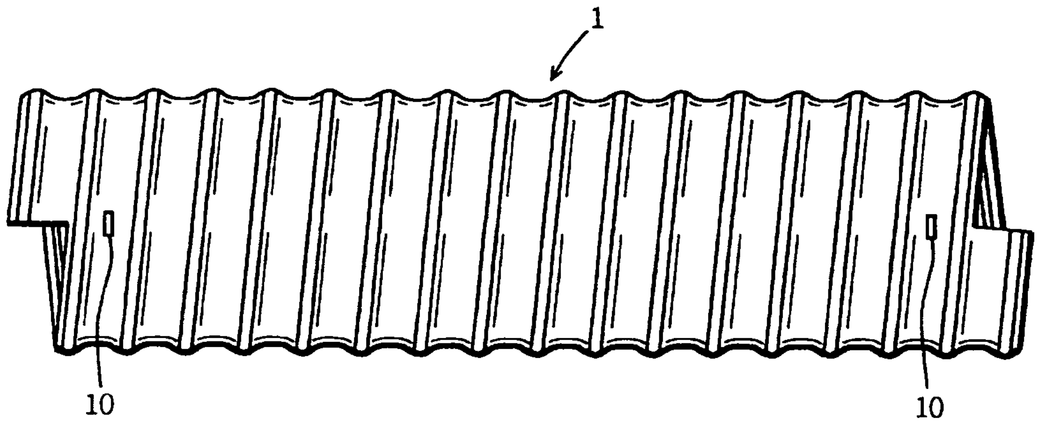


FIG. 5B

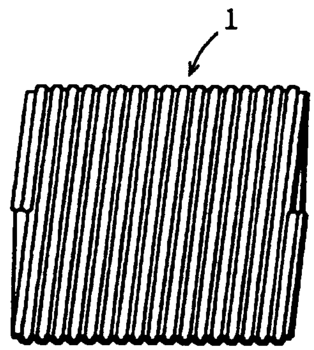
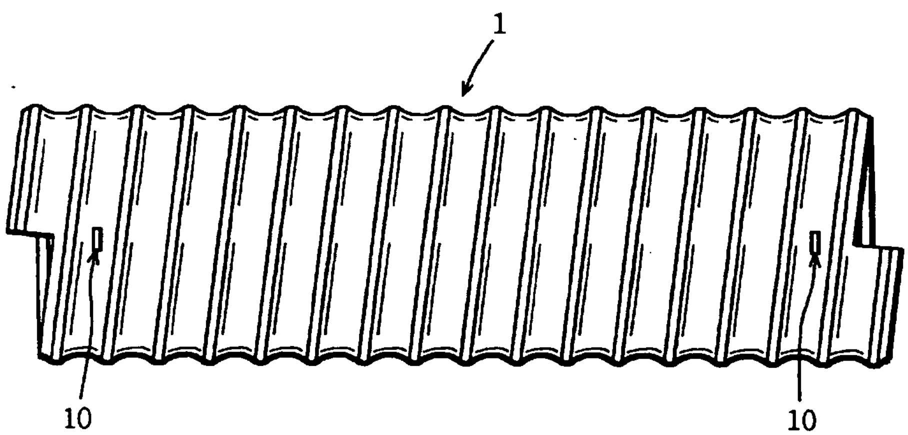


FIG. 5C



FLEXIBLE HOSE

FIELD OF THE INVENTION

The present invention relates to a flexible hose comprising a hose wall mainly formed with a thermoplastic polyurethane resin (particularly, a polyester-series thermoplastic polyurethane resin). In more detail, the present invention relates to a flexible hose (e.g. a duct hose such as air ducts) which is useful for transporting various gases.

BACKGROUND OF THE INVENTION

As the duct hose mentioned above, there have been popularly used hoses which comprise a hose wall formed by spirally winding a tape of a soft polyvinyl chloride resin (a plasticized polyvinyl chloride resin) and bonding its side edges each other, and a hard spiral reinforcement comprising a hard wire covered with a polyvinyl chloride resin or a hard spiral reinforcement of a hard polyvinyl chloride resin (non-plasticized polyvinyl chloride resin).

Usually, a hose wall of a duct hose of a synthetic resin is formed in the form of a bellows structure to give a flexibility, and the hose is transported or stored in a compressed state for compactness. As to storing circumstances, a storing temperature is in a wide range of as low as around -20° C. to as high as around 70° C., and it is often stored for quite a long period.

In the above case, when trying to lay a duct hose formed mainly with a vinyl chloride resin, the duct hose can not be reverted to the original length in a normal state because of its having been compressed for storage and caused shrinking kinks. As a result, the length of the hose is much shorter than the original length and consequently the hose is required to have the additional length allowing for shrinkage. In addition to such problems, there has been a problem that inwardly folded wall due to shrinkage results in an increased pressure loss.

For solving the problems of a vinyl chloride resin such as the formation of the shrinking kinks, there has been used mainly, as a synthetic resin material having a high impact resilience and hardly shrinks, a thermoplastic polyurethane resin, particularly a polyester-series thermoplastic polyurethane resin which is inexpensive, to form a duct hose.

However, a polyester-series thermoplastic polyurethane resin is degraded by ultraviolet rays, and the ester bonds of the polyester-series thermoplastic polyurethane are cleft with hydrolysis by exposure to a high temperature and high humidity for a long time, e.g., rain or the conveyance of aqueous liquids and the like. As a result, its physical properties such as wear resistance, flexibility and resilience are deteriorated.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a duct hose which has a high flexibility and durability, and hardly shows a shrinking kink (shrinking tendency).

It is another object of the present invention to provide a flexible hose which is capable of reverting its original length even after being stored in a compressed state in a longitudinal direction, of being easily stretched and of preventing pressure loss from lowering.

The flexible hose of the present invention has the following structures:

(1) A flexible hose, which comprises a main layer of a polyester-series thermoplastic polyurethane resin, a covering layer of a soft resin (e.g., a soft vinyl chloride resin) laminated on at least one surface of the main layer for forming a laminated tape, a hose wall formed by spirally winding the laminated tape and bonding the adjacent side edges of the covering layer each other and a hard spiral reinforcement for reinforcing the hose wall and retaining the hose configuration, wherein the shrinkage ratio of the length of the hose relative to the original length of the hose is 25% or less as determined by measuring the original length and the length of the hose in a normal condition (no-loading condition) after the test which comprises subjecting a hose compressed in a longitudinal direction to ten heating-cooling cycles successively, one cycle comprising heating step for exposing the compressed hose to an atmosphere of 70° C. for two hours, and cooling step for cooling the heat-treated hose at -20° C. for two hours, followed by returning the temperature to an ordinary or room temperature and allowing the hose to stand for one hour.

(2) The hose wall may comprise a main layer and a covering layer laminated on both inner and outer surfaces of the main layer. The thickness ratio of the main layer relative to the hose wall is about 0.7 to 0.95.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial sectional view showing one embodiment of the duct hose of the present invention;

FIGS. 2A and B show a partially enlarged sectional view of other embodiments of the present invention;

FIGS. 3A and B show a partially enlarged sectional view of other embodiments of the present invention;

FIG. 4 is a sectional view showing an example of a laminated tape; and

FIGS. 5A–C are a schematic view for explaining the heating/cooling-cycle test.

PREFERRED EMBODIMENTS OF THE INVENTION

The type of a polyester-series thermoplastic polyurethane resin is classified according to the species of a polyol component used as a soft segment. In this specification, a polyester-series thermoplstic polyurethane resin for forming the main layer of the hose wall indicates not only a thermoplastic polyurethane (TPU) prepared by use of a polyester polyol, but also a blend of the thermoplastic polyurethane with a thermoplastic resin such as a polyvinyl chloride, a polyester and polyamide, unless such incorporation of the thermoplastic resin alters the properties of the resin to a great extent.

A polyester-series thermoplastic polyurethane resin affords a hose a high flexibility and good impact resilience, and has excellent adhesion to a vinyl chloride resin. Thus, the use of a polyester-series thermoplastic polyurethane resin gives advantages that a hose wall comprising a main layer and a covering layer or covering layers of a soft vinyl chloride resin (a plasticized vinyl chloride resin) bonded and united with the inner surface and/or the outer surface of the main layer can be easily formed by extruding a laminated tape comprising a layer of a polyester-series thermoplastic polyurethane resin and a layer of a vinyl chloride resin directly fused each other in a crosshead of an extruder, and, as a result, the main layer formed with a polyester-series thermoplastic polyurethane resin is prevented from being hydrorized.

The shrinkage ratio (X), expressed as a percentage, of the hose length after the heating/cooling-cycle test is calculated by the following formula:

$$X=[(L-M)/L]\times 100$$

wherein "L" represents the length of the hose in a normal state before being tested and "M" shows the length of the hose in an unloaded condition after the test.

The hose of the present invention has a shrinkage ratio of 25% or less, preferably 20% or less and more preferably 15% or less.

As to the thickness ratio of the main layer and the covering layer(s) forming the hose wall, it is preferable to raise the thickness ratio of the main layer relative to the covering layer(s) to the level as high as possible in order to fully exhibit the excellent properties of the polyester-series thermoplastic polyurethane resin. The thickness ratio may be arbitrarily selected, provided that the shrinkage ratio (X) is maintained in the range of 25% or less, and the thickness ratio of the main layer relative to the hose wall is preferably 0.7 to 0.95 and more preferably 0.7 to 0.9.

The polyester-series thermoplastic polyurethane resin for forming the main layer can be produced by the rection of a polyester polyol (particularly, polyester diol) as a polyol component with a polyisocyanate (particularly, diisocyanate). A polyester polyol may be produced by a conventional manner, for example, an esterification of a polycarboxylic acid component or its reactive derivative with a polyol component, a ring-opening polymerization of a lactone (e.g., caprolactone), and a reaction of a polycarboxylic acid component or its reactive derivative with a polyol component and a lactone (e.g., caprolactone). The polyester polyol includes, for example, a polyester diol prepared by the reaction of an aliphatic saturated dicarboxylic acid and an aliphatic diol, and if necessary with an aromatic dicarboxylic acid or anhydride thereof and/or a lactone. Examples of the aliphatic dicarboxylic acid includes an C_{4-12} aliphatic saturated dicarboxylic acid such as adipic acid, pimelic acid, azelaic acid, and sebacic acid. As the aliphatic diol, there may be mentioned, for example, an C_{2-1}, alkylene glycol such as ethylene glycol, propylene glycol, butane diol, pentane diol, hexane diol, neopentyl glycol, and the like; a polyoxyalkylene glycol such as diethylene glycol, triethylene glycol, polyethylene glycol, dipropylene glycol, polypropylene glycol, polytetramethylene glycol, an ethylene glycol-propylene glycol block copolymer and the like. Preferred polyesters include, for example, a C_{4-12} aliphatic saturated dicarboxylic acid-based diols such as an adipic acid-based diol, a pimelic acid-based diol, an azelaic acid-based diol, and a sebacic acid-based diol.

The covering layer may be formed on at least one surface of the main layer. Usually, the covering layer is formed on both surfaces of the main layer. As a soft resin for forming the covering layer, there may be mentioned, for example, an ethylene-vinyl acetate copolymer, an ethylene-(meth) acrylate copolymer, an ethylene-(meth)acrylic acid copolymer, an ethylene-propylene copolymer, a soft vinyl chloride resin and so on. The soft vinyl chloride resin is preferable for forming the covering layer.

Hereinafter, referring to the drawings, the examples of the flexible hose of the present invention will be explained.

In FIG. 1, a duct hose 1 comprises a hose wall 2 of a corrugated configuration and a spiral hard reinforcement 3 adhered or thermally fused to the inner surface of the hose wall 2. The hose wall 2 (thickness: 0.5 mm) has a laminate structure comprising a main layer 4 (thickness: 0.4 mm) and covering layers 5,5 adhered or thermally fused to the inner and outer surfaces of the hose wall 2 (the thickness of each covering layer is 0.05 mm).

The main layer 4 of the hose wall 2 is formed with a polyester-series thermoplastic polyurethane resin. The covering layers 5,5 are formed with a soft resin such as a soft vinyl chloride resin, united with the main layer 4 by thermal fusing or thermal lamination. Moreover, the hard reinforcement 3 to be adhered to the hose wall 2 comprises a hard wire 6 and a coated layer 7 formed on the hard wire 6, and the coated layer 7 is formed with a soft resin such as a vinyl chloride resin which is the same material of the covering layer 5, i.e., a vinyl chloride resin, and thus intimately adheres to the covering layer 5. Therefore, the hard reinforcement 3 is firmly adhered and united with the covering layer 5.

The above-mentioned duct hose 1 is formed by the steps of;

spirally winding a laminated tape around an outer periphery of the hard reinforcement 3 having a diameter of 1.5 mm, and the laminated tape is extruded from an extruder and comprising a polyester-series thermoplastic polyurethane resin layer and a soft vinyl chloride resin layer fused and united with both inner and outer surfaces of the polyester-series thermoplastic polyurethane resin layer,

uniting the adjacent side edges of the laminated tape each other by thermally fusing to form the main layer 4 and the covering layers 5,5 simultaneously, and

uniting and fixing the coated layer 7 of the hard reinforcement 3 to the inner covering layer 5.

In this case, the outer diameter and the inner diameter of the hose are formed to be 63.5 mm and 58.5 mm, respectively.

A laminated tape T shown in FIG. 4 may be used, which is an extruded tape extruded from an extruder and comprises a polyester-series polyurethane resin layer 11 and a covering layer 12 of a soft vinyl chloride resin covering the whole circumference, i.e., the inner surface, the outer surface and both side surfaces, of the polyester-series thermoplastic polyurethane resin layer 11, and the polyurethane resin layer 11 is fused and united with the covering layer 12 of a soft vinyl chloride. In this case, the hose wall is formed by spirally winding the laminated tape T with fusing the adjacent side edges of the covering layer 12.

Moreover, as the above laminated tape, according to the intended applications of the hose, a laminated tape extruded from an extruder with thermally laminating and uniting a soft resin layer such as a soft vinyl chloride resin layer with either inner surface or outer surface of the polyester-series thermoplastic polyurethane resin layer may be used to form a protecting layer of the soft resin on either inner or outer surface of the hose.

FIG. 2 shows another embodiments of the duct hose 1. The embodiment (A) shows "an outer wire-type hose" which comprises a main layer 4 of the hose wall, an outer protecting layer 5 for protecting the main layer from hydrolysis, and a hard spiral reinforcement 3 adhered to the outer protecting layer. The embodiment (B) is "aburiedwire-type hose" in which a laminated tape is wound so as to be in a relation where the mutually adjacent side edges of the tape are overlapped, and to the overlap (the boundary area between the inner layer and the outer layer) is inserted the hard spiral reinforcement 3. Other structures are the same as those of the embodiment mentioned above.

FIG. 3 shows another embodiments of the duct hose. In each embodiment, a hard synthetic resin (e.g., a hard vinyl chloride resin) employed as a hard spiral reinforcement 3 is bonded or fixed to the covering layer 5 of the main layer 4 of the hose wall. As is the same in FIG. 4, the embodiment (A) represents an outer wire-type duct hose, and the embodiment (B) represents a buried wire-type duct hose. Also in

these embodiments, the hard spiral reinforcement **3** and the covering layer **5** may be formed with the same material, i.e., a vinyl chloride resin. Consequently, the adhesion between the two elements is improved and the improved adhesion strength is realized.

FIG. **5** illustrates a heating/cooling-cycle test in detail. As shown in FIG. **5** (A), marked lines **10,10** are put on the duct hose **1** in a normal state (no-loaded condition) at an arbitrary spacing, e.g., 500 mm. Then, as shown in FIG. **5** (B), the duct hose **1** is compressed or contracted in the axial direction and fixed with a suitable fixing means to maintain its compactness (compressed state).

After the compact duct hose **1** is subjected to ten cycles of alternate exposure to a high-temperature atmosphere and to a low-temperature atmosphere consecutively (one cycle: at 70° C. for two hours, and then at −20° C. for two hours), the temperature is raised to a room or ordinary temperature and allowed to stand for one hour. Then, as shown in FIG. **5** (C), the fixation of the compact duct hose **1** is released, and the duct hose is manually stretched to the original length and allowed to be in a normal state, and the distance between the marked lines **10, 10** is measured.

The shrinkage ratio of the duct hose shown in FIG. **1**, expressed as a percentage, is measured in such manner, and the measurement revealed the fact that the hose with the marking lines **10, 10** of, before being tested, 500 mm distance had shrunken to, after the test, 434 mm. The shrinkage ratio was calculated by the formula: (500−434)/500×100, and the value was 13%.

The same test as the above was conducted on duct hoses which are similar in structure to those of the above embodiments and have the inside diameter of 100 mm and 125 mm, respectively. The shrinkage ratio of each duct hose was 13%. On the other hand, as a comparative example, the above-mentioned test was conducted on a duct hose made of a soft vinyl chloride, and the shrinkage ratio was as high as about 50%.

Hoses according to the present invention have a high impact resilience and remarkably low shrinkage. Therefore, the advantages of the present invention resides in that the length of the hose can be efficiently utilized, that the pressure loss is small, and that its durability is excellent. As a result, the present invention can be favorably used as a duct hose with good flexibility.

What is claimed is:

1. A flexible hose, which comprises a main layer of a polyester-series thermoplastic polyurethane resin, a covering layer of a soft resin laminated on at least one surface of the main layer for forming a laminated tape, a hose wall formed by spirally winding the laminated tape and bonding the adjacent side edges of the covering layer each other, and a hard spiral reinforcement for reinforcing the hose wall and retaining the hose configuration, wherein the shrinkage ratio of the length of the hose in a normal condition (unloaded condition) is 25% or less relative to the original length of the hose as determined by measuring the original length and the length of the hose after the test which comprises subjecting the hose compressed in a longitudinal direction to ten heating/cooling-cycles successively, one cycle comprising a heating step for exposing the compressed hose to an atmosphere of 70° C. for two hours and a cooling step for cooling the heat-treated hose at −20° C. for two hours, followed by returning the temperature to an ordinary or room temperature and allowing the hose to stand for one hour.

2. A flexible hose as claimed in claim **1**, wherein said soft resin covering layer is formed with a soft vinyl chloride resin.

3. A flexible hose as claimed in claim **1**, wherein said hose wall comprises said main layer and covering layers laminated on both inner and outer surfaces of the main layer.

4. A flexible hose as claimed in claim **1**, wherein the thickness ratio of said main layer relative to the hose wall is 0.7 to 0.95.

5. A flexible hose as claimed in claim **1**, wherein the thickness ratio of the said main layer relative to said hose wall is 0.7 to 0.9.

* * * * *

US006607009B2

(12) **United States Patent**
Schoellhorn et al.

(10) **Patent No.:** **US 6,607,009 B2**
(45) **Date of Patent:** **Aug. 19, 2003**

(54) **SEWAGE SYSTEM FOR VEHICLES**

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(73) Assignee: **Marathon Coach, Inc.**, Coburg, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 64 days.

(21) Appl. No.: **09/881,293**

(22) Filed: **Jun. 13, 2001**

(65) **Prior Publication Data**

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(51) **Int. Cl.**^{7} **F15B 9/00**; F03C 1/12; F16K 27/12; F16L 3/00

(52) **U.S. Cl.** **137/899**; 137/355.12; 137/355.16; 4/323; 92/34

(58) **Field of Search** 137/899, 355.12, 137/355.16; 138/109, 121, 118.1; 4/323, 661; 92/34

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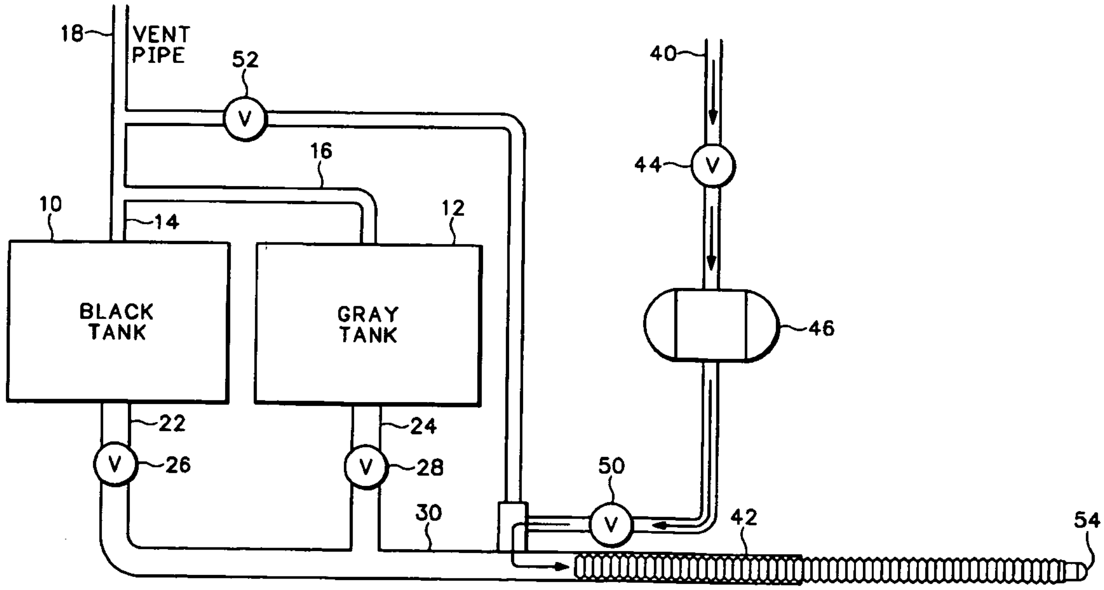
(74) *Attorney, Agent, or Firm*—Chernoff Vilhauer McClung & Stenzel, LLP

(57) **ABSTRACT**

A sewage system for vehicles that includes a waste hose that is extendable and retractable.

30 Claims, 2 Drawing Sheets



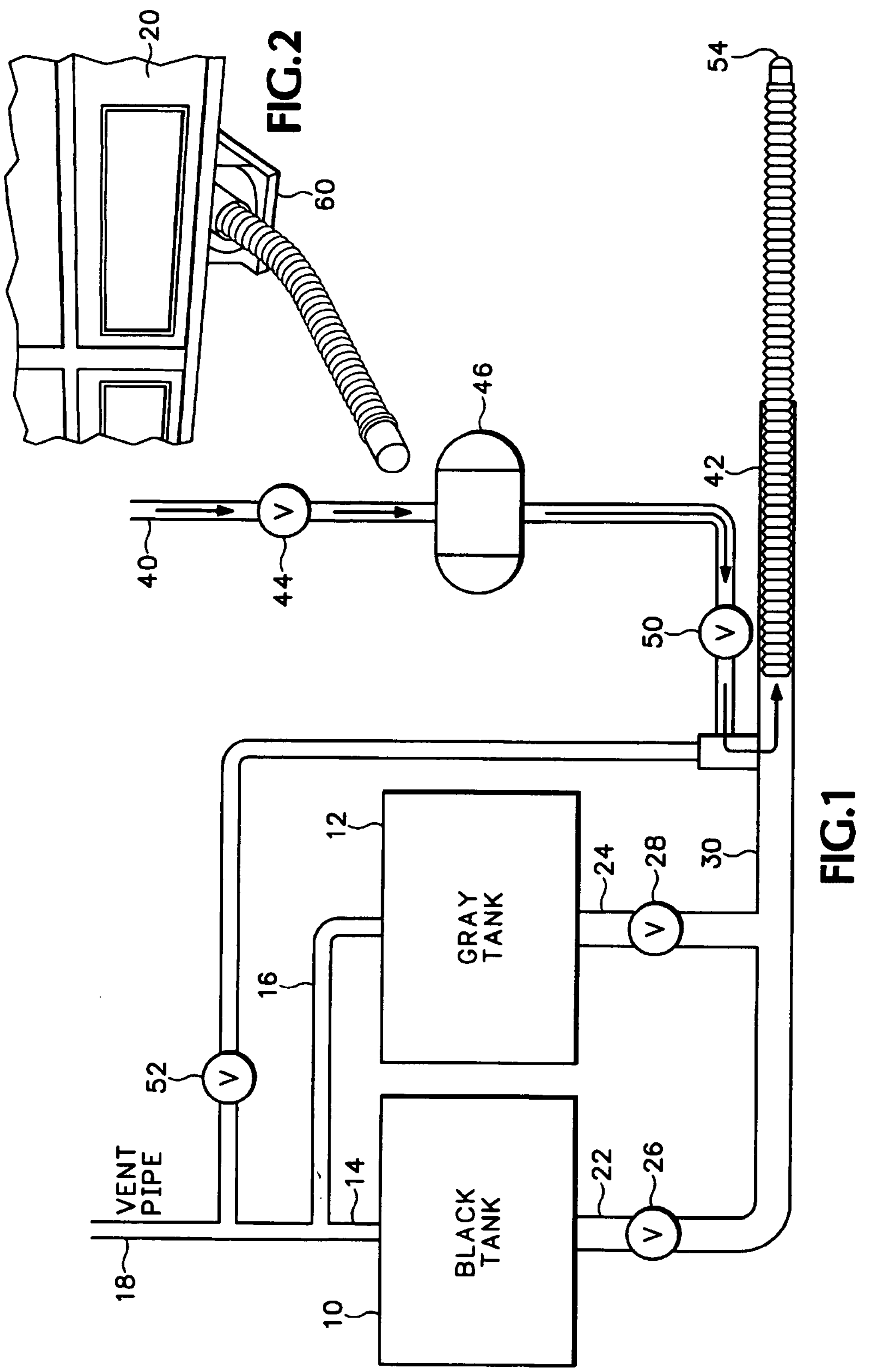

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FIG.2

FIG.1

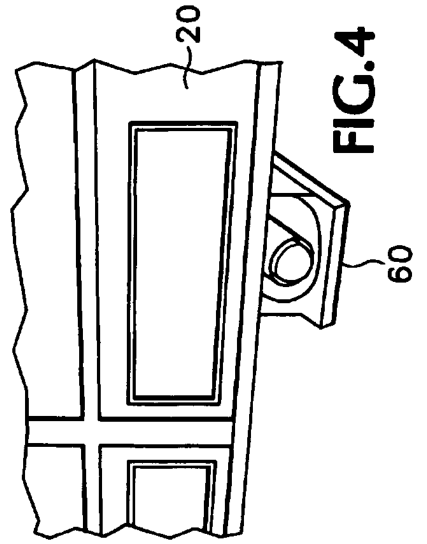
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FIG.4

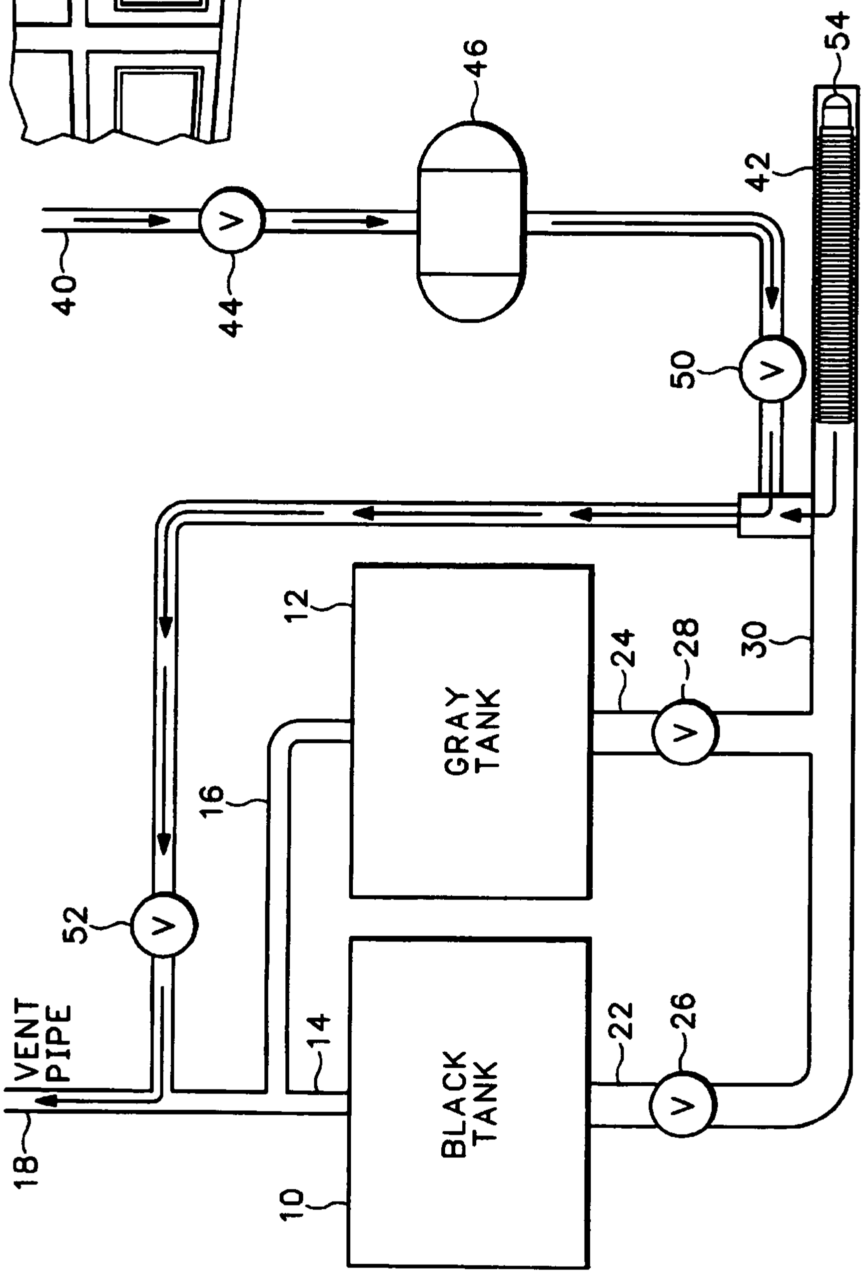
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FIG.3

SEWAGE SYSTEM FOR VEHICLES

BACKGROUND OF THE INVENTION

The present invention relates to a sewage system for a vehicle.

Many types of vehicles, such as recreational vehicles, travel trailers, fifth wheelers, buses, trucks, and the like have self-contained fluid systems, sinks, washing facilities and/or bathrooms. Each of these vehicles and others will be collectively referred to herein as "recreational vehicles" or "RVs". Such RVs include systems which store sewage and waste water until those materials can be properly disposed of. Typically, RVs generally utilize similar means of conducting waste to external storage tanks, dumps, or processing systems, such as those which are used in RV parks, truck stops, bus stops, and the like. Conventional RVs generally have two holding tanks, a sewage tanks (e.g., black tank) for receiving fluid sewage from the toilet system, and a grey water tank for receiving waste water, such as from the kitchen, bathroom sinks, and shower. These two holding tanks are interconnected to form a single liquid conduit drain line or drain pipe. RVs generally have an accessible external cabinet or storage facility which stores a length of flexible sewage discharge hose or other conduit. This discharge hose or other conduit may be manually connected to a fitting on the outlet stub of the drain pipe. The other end of the hose or other conduit is then extended to a dump fitting. Similarly, when the RV is preparing to move on, it is also necessary to handle the hose or other conduit, and flush the waste from it before storing it. These processes, i.e., dumping the waste from the holding tank into the inlet receptacle of the RV dump station and disconnecting and storing the hose or other conduit, are the messiest and most dreaded aspects of using an RV.

Besides the mess of dealing with the liquid waste problem, the predominate problem with the traditional sewage hose or other conduit system, is that the RV user must get on his or her knees and reach beneath the RV to attach the sewage hose or other conduit to the outlet pipe of the conduit beneath the RV. Consequently, there have been numerous devices which have been developed to increase the ease and/or reduce the clumsiness of attaching and detaching RV sewage hoses or other conduits. Many of such systems include flexible discharge hoses that are stored in a conduit extension member beneath the RV, and are telescopically moved therefrom when it is desired to secure the hose to a dump site. While these systems have their merits, these devices are stored permanently beneath the RV, and they still generally require the RV user to get on his or her knees to reach beneath the RV to access the sewage hose.

Mercer, U.S. Pat. No. 5,023,959, discloses a system for extending and retracting the waste hose for a waste disposal system that is typically found on recreational vehicles. The disposal system includes a power driven hose extender for extending the collapsible hose from its collapsed mode stored on-board the recreational vehicle to its extended configuration which it is used for dumping waste from an RV holding tank into an inlet of an RV waste dump station. In particular, a hose driver is used to axially displace threaded shafts, wherein an external collar engages around the accordion hose, which has a continuous helical rib.

Mercer, U.S. Pat. No. 4,133,347, discloses a waste evacuation attachment for a recreational vehicle that includes a rigid cylindrical housing readily mountable to the existing fitting of a sewage discharge outlet of the recreational

vehicle. A telescoping hose is contained within the housing and has a fitting on the extendable end to adapt the hose to waste receiving receptacles. The extension and retraction of the hose is by extending and retracting the hose within the housing. Foreman, U.S. Pat. No. 4,854,349, likewise discloses telescoping hose contained within a housing.

Hanemaayer, U.S. Pat. No. 5,653,262, discloses an axially extendable flexible hose connected to a waste outlet of a tank. An elongated tubular housing is provided within which the flexible hose extends such that the hose can be stored in the housing and also drawn outwardly of the distal end of the housing toward a waste receptacle. The housing has an articulated connection at a proximate end thereof adjacent the waste outlet. The extension and retraction of the hose is by extending and retracting the articulated hose within the housing.

Cook, U.S. Pat. No. 4,223,702, discloses a telescoping drain line for connecting recreational vehicles to a sewage system. The flexible hose extends through the telescoping pipe sections.

Feliz, U.S. Pat. No. 3,811,462; Boomgaarden, U.S. Pat. No. 5,244,003; Leech, U.S. Pat. No. 5,904,183; and Sargent et al., U.S. Pat. No. 4,779,650, likewise disclose telescoping tubular arrangements.

While many of the aforementioned systems provide telescoping tubular arrangements, they still require a substantial amount of effort on the part of the user to discharge the sewage.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exemplary schematic of a sewage system for a vehicle for extending a waste hose.

FIG. 2 is a side view of a portion of the vehicle of FIG. 1 showing the waste hose in the extended position.

FIG. 3 is an exemplary schematic of the sewage system for the vehicle of FIG. 1 for retracting the waste hose.

FIG. 4 is a side view of a portion of the vehicle of FIG. 3 showing the waste hose in the retracted position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, an exemplary waste system for a RV of the present invention may include a black tank **10** for holding toilet sewage and a grey tank **12** for holding other waste water, such as for example, the sink or the shower. The black tank and the grey tank **12** may be replaced by a single storage container, if desired. The black tank **10** and the grey tank **12** are interconnected by pipes **14** and **16** to a vent pipe **18**. The vent pipe **18** is preferably vented to the exterior of the recreational vehicle **20** (see FIG. 2) which provides for air flow into and out of the waste system. The black tank **10** may be drained through a drain pipe **22** when a black waste valve **26** is opened. Conversely, when the black waste valve **26** is closed the waste in the black tank **10** is not drained. Similarly, the grey tank **12** may be drained through a drain pipe **24** when a grey waste valve **28** is opened. Conversely, when the grey waste valve **28** is closed the waste in the grey tank **12** is not drained. The waste from the grey tank **12** and black tank **10** are preferably joined into a single drain pipe **30** for eventual discharge from the RV into a suitable receptacle. Multiple drain pipes for discharge of materials from the RV may be used, if desired.

After consideration of the typical recreational vehicle, the present inventors came to the realization that many recreational vehicles include an internal compressor which pro-

vides pressurized air (or other gas) that may be used by the waste system. The waste system may use the pressurized air to provide automatic extension and retraction of the waste hose **42**. Using an existing pressurized air source reduces the expense of an automated extension and retraction of the waste hose **42**. The automatic extension alleviates the need for the user to bend down under the RV or otherwise manually extend and retract the waste hose **42**. The waste system preferably includes an intake **40** that provides air pressure from the recreational vehicle **20**. The air pressure within the intake may be provided from the recreational vehicle **20** powered when the engine is running or otherwise a compressor within the recreational vehicle **20**. An intake check valve **44** is preferably a "one-way" valve that substantially only permits air flow in a single direction, as indicated by the arrows. In this manner, the air flow will not flow back to the pressurized air source. An air tank **46** is preferably included that stores additional compressed air, such as a 7 gallon tank, so that sufficient air pressure is obtained without having to increase the capacity of the air compressor. It is to be understood that valve, as used herein, refers to any mechanism that is suitable to control the flow, stop the flow, restrict the flow or otherwise, of materials through a tubular member.

When the user desires to extend the waste hose **42**, a check valve **50** is opened which permits air pressure to flow through the check valve **50** and into the drain pipe **30**. A vent check valve **52** is preferably closed to primarily restrict the air flow through the drain pipe **30**. Likewise, preferably the black waste valve **26** and the grey waste valve **28** are closed. Accordingly, substantially all the air flow will be acting upon the waste hose **42** which is preferably slidably engaged with the waste system. More preferably the waste hose **42** (or a majority thereof) is freely slidably engaged with the waste system over a majority of its extension. Moreover, the waste hose **42** may rotatably extend or move based upon other mechanisms in such a manner as to extend from the vehicle. The pressure exerted on the end portion of the waste hose **42**, capped by a detachably engageable cover **54**, will cause the waste hose **42** to slide outwardly from the recreational vehicle **20**, as illustrated in FIG. **2**. In this manner, by simply opening the valve **50** the waste hose **42** may be slidably extended in a manner that is free from the user having to manually pull or otherwise extend the waste hose. After extending the waste hose **42** the cover **54** is removed and the waste hose **42** is interconnected with the suitable waste receptacle. Other air pressure techniques may likewise be used to extend the waste hose **42**, such as for example, air pressure against the interior end **54** of the waste hose **42** as opposed to air pressure against the cover **54**, an air pressure operated rotational mechanism that extends/retracts the waste hose **42**, and a hydraulics based pressure extension/retraction mechanism. Moreover, if desired the air pressure mechanism may be replaced by an electrical extension/retraction system or other type of extension/retraction system that automatically extends and/or retracts the waste hose **42**. Thereafter the black tank and/or the grey tank may be emptied into the receptacle by selectively opening the black waste valve **26** and/or the grey waste valve **28**, respectively. The waste hose **42** may be, for example, articulated, non-articulated, extendable lengthwise, non-extendable lengthwise, substantially non-compressible, and/or substantially compressible. Further, the waste hose **42** may be any type of tubular member having any cross sectional profile(s) suitable to pass liquids through.

For example, the waste system may be used to extend the waste hose **42** as follows. Initially a button, a lever, or other user initiation of the waste system is performed. The vent check valve **52** is closed if not already closed, the black waste valve **26** is closed if not already closed, the grey waste valve **28** is closed if not already closed, and the check valve **50** is opened if not already opened. The air from the air intake **40** and/or air from the air tank **46** provides air pressure against the waste hose **42** (or other mechanism) which causes the waste hose **42** to slidably extend outwardly from the vehicle **20**. The user then removes the cover **54** and engages the waste hose **42** with the receptacle.

Referring to FIG. **3**, the waste system may retract the waste hose **42** as follows. The user disengages the waste hose **42** from the receptacle and replaces the cover **54**. The user then presses a button, a lever, or other user initiation of the waste system if performed. The vent check valve **52** is opened if not already opened, the black waste valve **26** is closed if not already closed, the grey waste valve **28** is closed if not already closed, and the check valve **50** is opened if not already opened. The air from the air intake **40** and/or air from the air tank **46** provides air pressure that passes through the vent check valve **52** which creates a vacuum within the waste hose **42** which causes the waste hose **42** to retract inwardly toward the vehicle **20**, as illustrated in FIG. **4**. After completing usage of the waste system, the vent check valve **52**, the check valve **50**, the black waste valve **26**, and/or the grey waste valve **28** are preferably closed.

After further consideration, the present inventors determined that having a stationary opening under the recreational vehicle **20** for the waste hose **42** permits the waste hose **42** to be inadvertently damaged while traveling. Moreover, having a manually removable cover for the stationary opening, while advantageous, still requires the user to manually remove the cover. Referring to FIGS. **2** and **4**, preferably the waste hose **42** is supported by a movable support **60**. In a closed position, the support **60** rotates, raises, or otherwise moves such that the waste hose **42** is not free to extend. Also, the support **60** moves the end of the waste hose **42** to a position that is protected from the exterior elements when not in use. Moreover, preferably upon moving the support **60** to an opened position, the end of the hose is directed at an acute angular relationship, such as for example 10–45 degrees, with respect to the ground. This angular relationship assists in directing the waste hose **42** across the ground in a manner that facilitates extension of the waste hose **42**.

All references discussed herein are hereby incorporated by reference.

The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

What is claimed is:

1. A liquid water materials system for a vehicle comprising:

(a) a storage container for liquid waste materials;

(b) an elongate tubular member through which said waste materials may flow, wherein said elongate tubular member has an end;

(c) said end of said elongate tubular member is movable from a first position to a second position, wherein said end when in said second position is further distant from said vehicle than said end in said first position; and

(d) wherein said movement of said end is in response to air pressure exerted within said tubular member.

2. The system of claim 1 wherein said storage container includes a first container and a second container.

3. The system of claim 1 wherein said first container stores toilet sewage and said second container stores shower waste water.

4. The system of claim 1 wherein said storage container is vented to the exterior of said vehicle.

5. The system of claim 3 further comprising a first valve interconnected to the output of said first container and a second valve interconnected to the output of said second container.

6. The system of claim 1 further comprising an air tank that provides pressurized air for said movement.

7. The system of claim 6 further comprising first check valve interconnected to the output of said air tank and a second check valve interconnected to the input of said air tank.

8. The system of claim 1 further comprising a valve that selectively causes said movement of said end.

9. The system of claim 1 further comprising said end of said elongate tubular member being movable from said second position to said first position, wherein said end when in said second position is further distant from said vehicle than said end in said first position, wherein said movement of said end is in response to air pressure.

10. The system of claim 1 further comprising said end of said elongate tubular member being movable from said second position to said first position, wherein said end when in said second position is further distant from said vehicle than said end in said first position, wherein said movement of said end is in response to air pressure.

11. A liquid water materials system for a vehicle comprising:

(a) a storage container for liquid waste materials;

(b) an elongate tubular member through which said waste materials may flow, wherein said elongate tubular member has an end;

(c) said end of said elongate tubular member is movable from a first position to a second position, wherein said end when in said second position is further distant from said vehicle than said end in said first position; and

(d) wherein said movement of said end is slidably engaged with said vehicle free from engagement with external ribs of said tubular member.

12. The system of claim 11 wherein said storage container includes a first container and a second container.

13. The system of claim 12 wherein said first container stores toilet sewage and said second container stores shower waste water.

14. The system of claim 11 wherein said storage container is vented to the exterior of said vehicle.

15. The system of claim 13 further comprising a first valve interconnected to the output of said first container and a second valve interconnected to the output of said second container.

16. The system of claim 11 further comprising an air tank that provides pressurized air for said movement.

17. The system of claim 16 further comprising first check valve interconnected to the output of said air tank and a second check valve interconnected to the input of said air tank.

18. The system of claim 11 further comprising a valve that selectively causes said movement of said end.

19. The system of claim 11 further comprising said end of said elongate tubular member being movable from said second position to said first position, wherein said end when in said second position is further distant from said vehicle than said end in said first position, wherein said movement of said end is slidably engaged with said vehicle.

20. The system of claim 11 wherein said movement is in response to air pressure.

21. A liquid water materials system for a vehicle comprising:

(a) a storage container for liquid waste materials;

(b) an elongate tubular member through which said waste materials may flow, wherein said elongate tubular member has an end;

(c) said end of said elongate tubular member is movable from a first position to a second position, wherein said end when in said second position is further distant from said vehicle than said end in said first position; and

(d) wherein said movement of a majority of said tubular member is slidably engaged with said vehicle over a majority of the distance between said first position and said second position.

22. The system of claim 21 wherein said slidable engagement is freely slidably engaged.

23. The system of claim 21 wherein said storage container includes a first container and a second container.

24. The system of claim 23 wherein said first container stores toilet sewage and said second container stores shower waste water.

25. The system of claim 21 wherein said storage container is vented to the exterior of said vehicle.

26. The system of claim 21 further comprising a first valve interconnected to the output of said first container and a second valve interconnected to the output of said second container.

27. The system of claim 21 further comprising an air tank that provides pressurized air for said movement.

28. The system of claim 27 further comprising first check valve interconnected to the output of said air tank and a second check valve interconnected to the input of said air tank.

29. The system of claim 21 further comprising a valve that selectively causes said movement of said end.

30. A liquid water materials system for a vehicle comprising:

(a) a storage container for liquid waste materials;

(b) an elongate tubular member through which said waste materials may flow, wherein said elongate tubular member has an end;

(c) said end of said elongate tubular member is movable from a first position to a second position, wherein said end when in said second position is further distant from said vehicle than said end in said first position; and

(d) wherein said end of said elongate tubular member is maintained in a first elevation prior to movement from said first position to said second position, wherein said end of said tubular member is maintained in a second elevation prior to movement from said first elevation to said second elevation, wherein said first elevation is lower than said second elevation, wherein said end of said tubular member is moved from said second elevation to said first elevation prior to moving from said first position to said second position.

* * * * *

US 20020079017A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2002/0079017 A1**

Fields (43) **Pub. Date: Jun. 27, 2002**

(54) **MOTORIZED WASTE HOSE FOR RECREATIONAL VEHICLE**

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(21) Appl. No.: **10/014,100**

(22) Filed: **Dec. 11, 2001**

Related U.S. Application Data

(63) Non-provisional of provisional application No. 60/257,409, filed on Dec. 22, 2000.

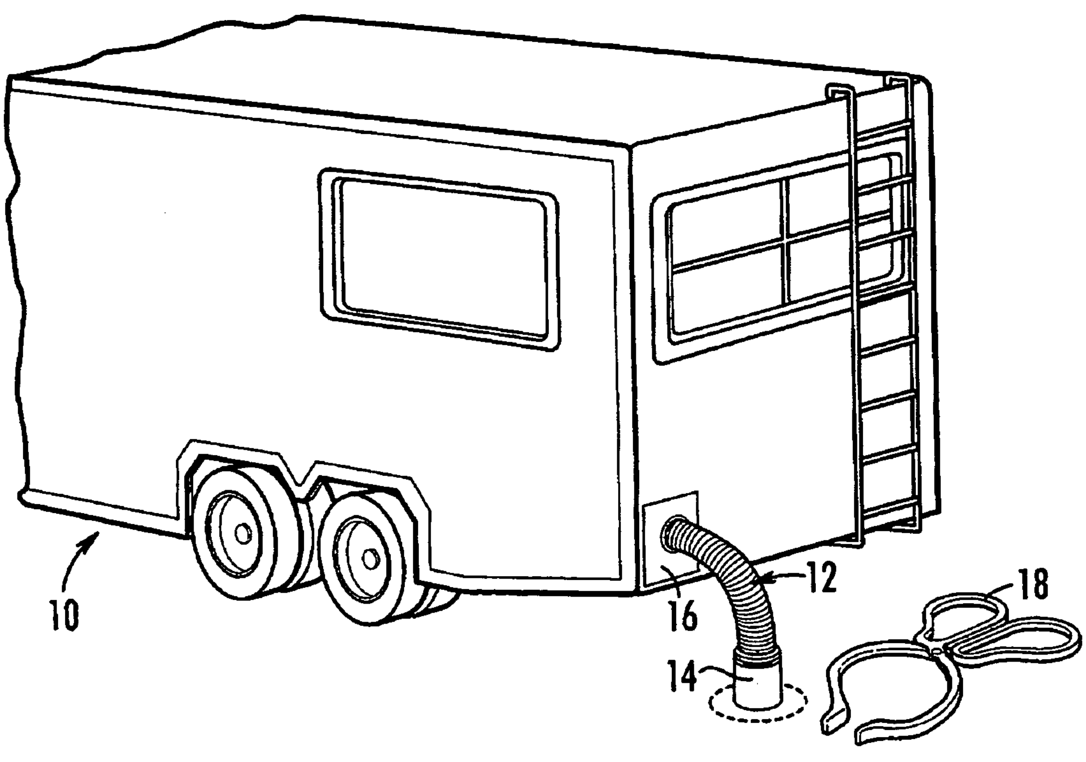
Publication Classification

(51) **Int. Cl.**[7] **B65B 31/04**

(52) **U.S. Cl.** **141/65**; 141/387

(57) **ABSTRACT**

Draining of the waste tank of a recreational vehicle is improved by using a motor to operate the waste hose. The motor causes the proximal end of the hose to be extended from its housing in the RV while the distal end remains attached to the waste tan. The extended proximal end can then be inserted into the access pipe of a sewer system for draining the waste tank. The motor will retract the hose when the waste tank has been emptied. The motor is operable either by throwing a switch on the motor or pressing a button on a remote control unit.



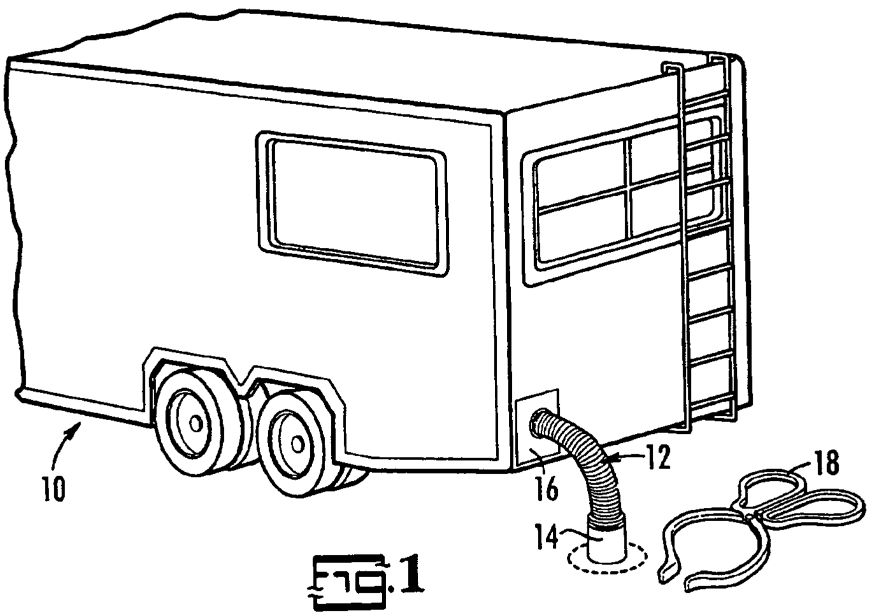

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FIG. 1

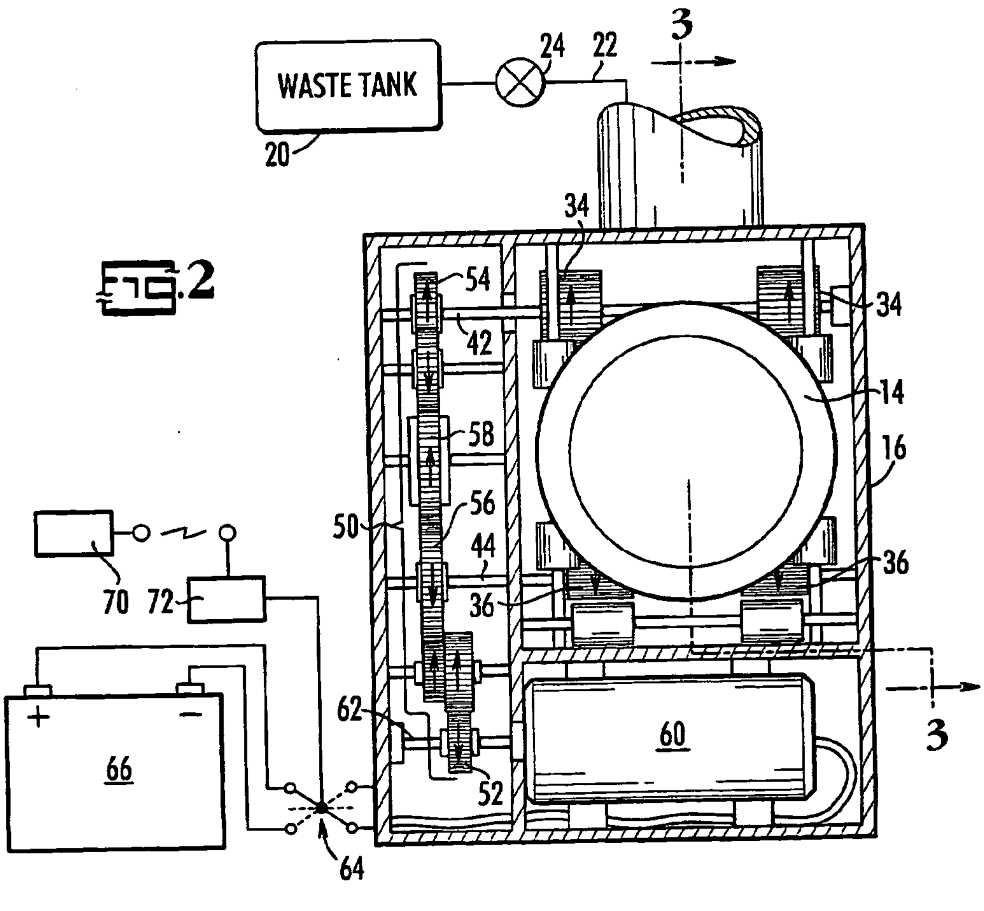
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FIG. 2

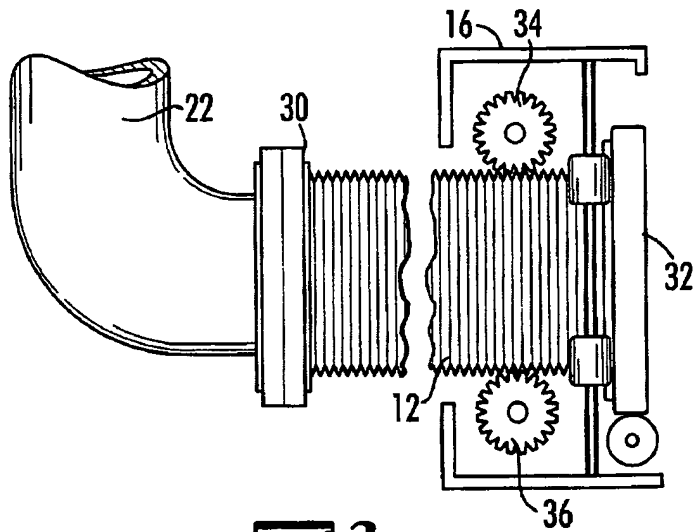

FIG. 3

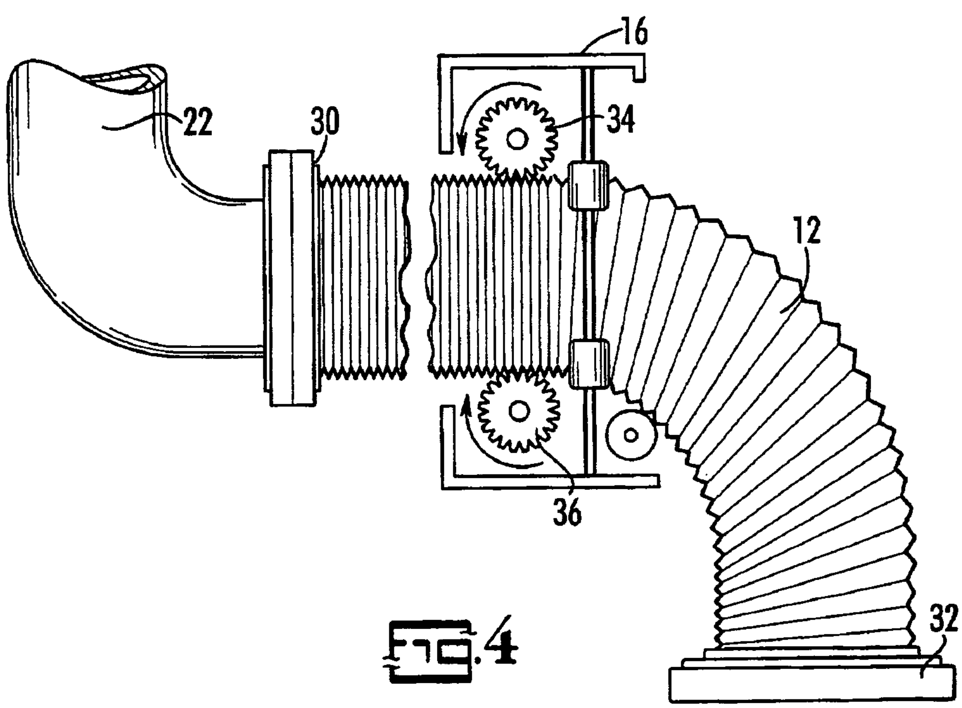

FIG. 4

MOTORIZED WASTE HOSE FOR RECREATIONAL VEHICLE

PRIORITY CLAIM

[0001] The applicant claims the benefit of the filing of US provisional application Ser. No. 60/257,409 filed 12/22/2000, which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to the operation of the living quarters of recreational vehicles. More particularly, it relates to the expunging of the waste tank of the recreational vehicle.

BACKGROUND OF THE INVENTION

[0003] There are a many different types of recreational vehicles, often referred to as "RVs". One type of RV has living quarters that include a toilet, washing and kitchen facilities. The waste products from these are collected in an on-board tank that must be periodically expunged.

[0004] The process for expunging the waste tank is relatively straight forward. The RV must stop next to a sewer system access pipe, commonly found at RV parks, where the operator of the RV connects the waste tank via a hose to the access pipe. Then, a valve is opened to allow the waste from the tank to drain by gravity into the sewer system.

[0005] The hose is connected permanently to the RV waste tank and stored in a compartment toward the back of the vehicle. The hose is expandable that can be compressed to fit within its compartment, usually in the bumper, or stretched so that it can be inserted into the sewer system.

[0006] This operation may be straightforward, but it is also a disagreeable task. RV's are designed to allow relatively convenient draining of its waste tank and sewer system access pipes are available at convenient locations for RV travelers, but ultimately, the operator of the RV must still undertake the chore of draining the tank. Furthermore, the end of the hose becomes fouled with waste. Odors add to the disagreeable nature of the task.

[0007] Thus, there remains a need for improvements in the way the waste tank of an RV is emptied to lessen the disagreeable aspects of this chore.

SUMMARY OF THE INVENTION

[0008] According to its major aspects and briefly recited, the present invention is a motorized device to extend and retract the waste hose of an RV. The motorized device causes the proximal end of the hose to be extended from the RV so that it can be inserted into the access pipe of a sewer system and will retract it when the waste tank has been emptied. The device is operable either by throwing a switch to activate a motor or pressing a button on a remote control unit.

[0009] The use of a motor is an important feature of the present invention. The use of a motor obviates the need to physically pull the hose from its compartment and to push it back into the compartment, which are both disagreeable tasks.

[0010] The operation of the motor using a remote control is another feature of the present invention. The use of the remote also allows the RV operator conduct the procedure in part without having to go to a fixed set of controls.

[0011] These and other features and their advantages will be apparent to those skilled in the art of RV usage and design from a careful reading of the Detailed Description of Preferred Embodiments, accompanied by the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] In the drawings,

[0013] **FIG. 1** is a perspective view of an RV with the waste hose connected to the access pipe of a sewer system;

[0014] **FIG. 2** is an end view and partial schematic view of the present motor according to a preferred embodiment of the present invention;

[0015] **FIG. 3** is a side view of the present motor and waste hose in the retracted position, according to a preferred embodiment of the present invention; and

[0016] **FIG. 4** is a side view of the present motor and waste hose in the extended position, according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0017] The present invention is a motorized device for use in extending and retracting a waste hose of a recreational vehicle (referred to herein as an "RV"). The invention is also the combination of a motor, controls for the motor, a waste hose and an RV.

[0018] The RV, whether part of the combination that is the invention or not, is one equipped with a waste tank that must periodically be drained. When it is drained, the waste from the waste tank is drained into a sewer system through an access pipe. The sewer system and access pipe, and the waste are of course not part of the present invention.

[0019] Referring now to the figures, there is illustrated an RV, generally indicated by reference number **10**, having a waste hose **12** that can be inserted into a sewer system (not shown) via an access pipe **14**. A housing **16** carries waste hose **12**. Housing **16** preferably has a cover (not shown). For manipulation of the free end of the extended waste hose **12**, a gripper **18**, shown slightly enlarged in **FIG. 1** for clarity, proves convenient.

[0020] **FIG. 1** shows the waste hose **12** mounted to a left, rear corner of RV **10** but it will be clear that waste hose **12** can exit RV **10** from other parts of RV **10**, including the sides and other areas of the back of RV **10**. The bumper of an RV can double as a compartment for hose **12**.

[0021] RV **10** has a waste tank **20** and a pipe **22** leading from and in fluid communication with waste tank **20**. A valve **24** controls the flow of waste from waste tank **20** through pipe **22**. When valve **24** is opened, the waste drains by gravity from waste tank **20** through pipe **22**. When valve **24** is closed, no further waste may drain.

[0022] Waste hose **12** has a distal end **30** that is coupled to pipe **22**, so that waste hose **12** is in fluid communication with waste tank **20**, and a proximal end **32** near the exit of housing **16**. Waste hose **12** is adapted to be stretched in

length, preferably because of its ribbed or "accordian" or "corrugated" construction, as shown in **FIGS. 3A and 3B**, so that hose **12** can be moved between a retracted position and an extended position by moving proximal end **32** with respect to distal end **30**. By the term "extended", then, it is meant that proximal end **32** is moved so that the distance between it at distal end **30** is increased but that distal end **30** and proximal end **32** remain in fluid communication. Importantly, waste tank **20** and proximal end **32** also remain in fluid communication via the coupling between waste hose **12** and pipe **22** at distal end **30** when waste hose **12** is extended.

[0023] Inside housing **16** is means for extending waste hose **12**. Preferably, rollers **34** and **36** are used to push proximal end **32** from housing **16**, to the extended position from the retracted position, either mechanically or electromechanically thereby extending waste hose **12**. Rollers **34** and **36** are affixed to shafts **42** and **44**, respectively, which are mounted in bearings (not shown) carried by housing **16**.

[0024] Shafts **42** and **44** are rotated using a system of gears **50** that accomplish several things. First, they rotate rollers **34** and **36** in opposing directions. As shown in **FIGS. 3A and 3B**, when rollers **34** rotate counter-clockwise, rollers **36** rotate clockwise so that waste hose **12** is extended. When rollers **34** rotate clockwise, rollers **36** rotate counter-clockwise so that waste hose **12** is retracted. Second, gear system **50** causes the rotation of gears **34** and **36** at the same rate so that waste hose **12** is extended and retracted straight out of housing **16**. Third, gear system **50** adjusts the rate at which waste hose **12** would otherwise be extended and retracted by a power source (to be described below) so that the extension and retraction takes place at a reasonable, controlled rate.

[0025] The composition and arrangement of gears in gear system **50** that is needed to achieve the foregoing requirements is well within the level of skill of those skilled in the art and clearly depends on the choice of gears, the distance between shafts **42** and **44**, and the speed of a motor **60** driving the gears. However, there is preferably a driving gear **52** connected directly to motor **60**, one driven gear **54** for shaft **42**, one driven gear **56** for shaft **44** and one direction-reversing gear **58**. Additional gears may be needed to step down the speed of an output shaft **62** of motor **60** and possibly to connect driving gear **52** with driven gears **54** and **56**. Other arrangements are possible, such as using separate motors to drive shafts **42** and **44** and direct drive of one or both shafts **42** and **44**.

[0026] Motor **60** is activated by a battery **66** of RV **10** via a switch **64**. Switch **64** can be located at housing **16** or inside RV. In lieu of motor **60**, a hand crank (not shown) can be easily substituted. Also, as an alternate to a switch **64** or in addition to switch **64**, a remote control unit **70** can be used to transmit a signal to a receiver **72** that operates switch **64**.

[0027] Switch **64** is preferably a three-way switch as shown, with an "off" position, a "forward" position" and a "reverse" position. In the forward position, waste hose **12** is extended by motor **60**; in the reverse position, waste hose **12** is retracted by motor **60**. Switch **64** may be switched to the off position when waste hose **12** has been retracted far enough or other features maybe incorporated to limit the rearward travel of waste hose **12**, such as limit switches (not shown) that would automatically stop motor **60** when waste hose **12** had returned fully to housing **16**. The maximum extension of waste hose **12** can be obtained when rollers **34** and **36** slip from their inability to further extend waste hose **12** or by incorporating an electrical contact that is closed when sufficient extension is obtained.

[0028] In operation, an RV operator stops RV near access pipe **14**, closes switch **54** either manually by pressing a button or by using remote control unit **70** in electrical communication with a receiver **72**, which is in turn in electrical connection with battery **66** and switch **64**. Battery **66** energizes motor **60** which rotates output shaft **62**. Gear system **50** causes shafts **42** and **44** to rotate which in turn rotates rollers **34**, **36**, respectively. Rollers **34**, **36**, extend proximal end **32** of waste hose **12** from motor housing so that the operator can merely place proximal end **32** into access pipe **14** using gripper **18**. The valve **24** is opened and waste tank **20** drains by gravity. When waste tank **20** is drained, valve **24** is closed, gripper **18** is used to remove proximal end **32** of waste hose **12** from access pipe **14** and switch **64** is moved to the retract position. Motor **60** operates in reverse, based on reversal of its polarity and retracts waste hose **12**. Gear system **50** operates in reverse to draw proximal end **32** of waste hose **12** back toward motor housing **16**.

[0029] It will be apparent to those skilled in the art of electro-mechanical motors that many substitutions and modifications can be made to the preferred embodiments described above without departing from the spirit and scope of the present invention, which is defined by the appended claim.

What is claimed is:

1. A device for use with a recreational vehicle having a waste tank, said device comprising:

a housing;

a waste hose having a proximal end and a distal end, said distal end in fluid connection with said waste tank; and

means for moving said waste hose between a retracted position inside said housing and an extended position wherein said proximal end is out of said housing while said distal end remains in fluid connection with said waste tank.

2. The device as recited in claim 1, wherein said moving means further comprises:

a motor;

means responsive to said motor for rolling said hose between said retracted and said extended positions.

3. The device as recited in claim 1, wherein said moving means further comprises:

rollers engaging said waste hose, said waste hose moving between said retracted and said extended positions when said rollers rotate; and

means for rotating said rollers.

4. The device as recited in claim 1, wherein said moving means further comprises:

a motor;

a shaft rotated by said motor;

a gear system responsive to said motor; and

rollers rotated by said gear system, said rollers engaging said waste hose and moving said waste hose when said rollers are rotated.

5. The device as recited in claim 1, wherein said device further comprises means for limiting movement of said hose by said moving means.

6. A device for use with a recreational vehicle having a waste tank, said device comprising:

a housing;

a hose carried within said housing and having a proximal end and an a distal end, said distal end being in fluid communication with a waste tank of a recreational vehicle;

a motor in said housing;

moving means responsive to said motor for moving said hose between an extended position wherein said proximal end is out of said housing and a retracted position wherein said hose is in said housing; and

control means for controlling said motor.

7. The device as recited in claim 6, wherein said moving means further comprises:

a shaft rotated by said motor;

a gear system rotated by said shaft; and

rollers rotated by said shaft, said rollers engaging and rolling said hose between said extended and said retracted positions.

8. The device as recited in claim 6, wherein said hose is corrugated to stretch so that said distal end remains in fluid connection with said waste tank when said hose is in said extended position.

9. The device as recited in claim 6, further comprising means for limiting the movement of said hose by said moving means.

10. The device as recited in claim 6, wherein said control means is a remote control unit, said motor being responsive to said remote control unit.

11. The device as recited in claim 6, further comprising a power source for powering said motor.

12. The device as recited in claim 6, further comprising a gripper for manipulating said hose when said hose is moved to said extended position.

13. A device for use with a recreational vehicle, said recreational vehicle having a waste tank, a waste pipe extending from and in fluid communication with said waste tank, a valve governing fluid flow from said waste tank through said waste pipe, a bumper and a battery, said device comprising:

a hose carried within the bumper of a recreational vehicle and having a proximal end and an a distal end, said distal end being in fluid communication with a waste pipe of a recreational vehicle;

moving means responsive to said motor for moving said hose between a retracted position wherein said hose is in said bumper and an extended position wherein said proximal end is out of said bumper.

14. The device as recited in claim 13, wherein said moving means further comprises:

a pair of spaced-apart rollers through which said hose rolls between said extended and said retracted positions;

means for rolling said rollers.

15. The device as recited in claim 14, wherein said rolling means is a hand crank.

16. The device as recited in claim 14, wherein said rolling means further comprises:

a motor connected to a battery of said recreational vehicle;

a shaft rotatable by said motor;

a gear system rotated by said shaft, said gear system rotating said rollers to move said hose between said extended and said retracted positions.

17. The device as recited in claim 14, wherein said rolling means further comprises means for controlling said rolling means.

18. The device as recited in claim 17, wherein said rolling means is a remote control unit.

19. The device as recited in claim 16, wherein said rolling means further comprises means for limiting movement of said hose.

20. The device as recited in claim 16, wherein said hose is corrugated to allow said hose to stretch so that said distal end remains attached to said waste pipe when said proximal end is in said extended position.

* * * * *

US006224345B1

(12) **United States Patent**
Dussault

(10) **Patent No.: US 6,224,345 B1**
(45) **Date of Patent: May 1, 2001**

(54) PRESSURE/VACUUM GENERATOR

(75) Inventor: **Christopher C. Dussault**, Bennington, VT (US)

(73) Assignee: **Bijur Lubrication Corporation**, Bennington, VT (US)

(21) Appl. No.: **09/273,986**

(22) Filed: **Mar. 22, 1999**

(51) **Int. Cl.**^{7} **F04F 1/06**; F04F 5/48
(52) **U.S. Cl.** **417/138**; 417/182; 417/182.5
(58) **Field of Search** 417/138, 182, 417/182.5, 185

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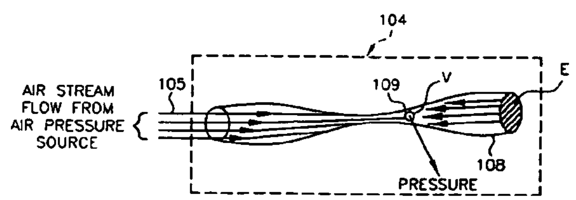
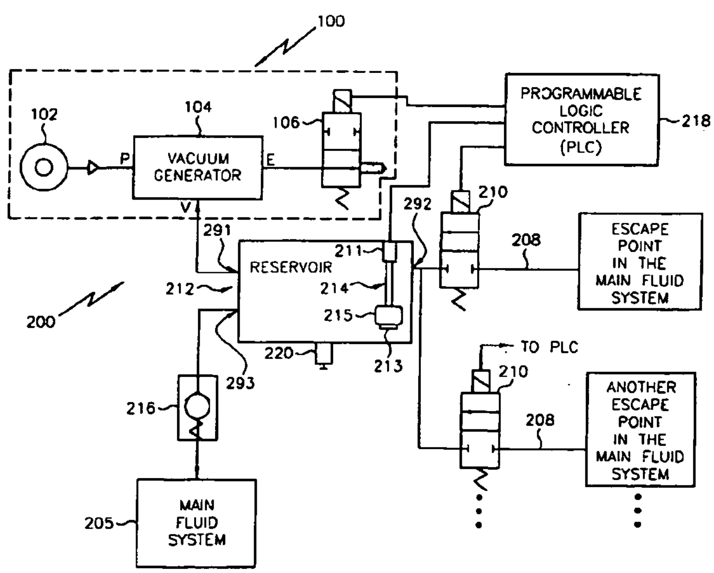
Primary Examiner—Timothy S. Thorpe
Assistant Examiner—Michael K. Gray
(74) *Attorney, Agent, or Firm*—Caesar, Rivise, Bernstein, Cohen & Pokotilow, Ltd.

(57) **ABSTRACT**

A pressure/vacuum generator is established by coupling the pressure port of a vacuum generator to an air pressure source while coupling a valve in fluid communication with the exhaust port of the vacuum generator. When the valve is in a normally open condition (i.e, the exhaust vented to atmosphere), the vacuum port of the pressure/vacuum generator generates a vacuum. When the valve is closed, thereby closing off the exhaust port, the vacuum port becomes a pressure port. Thus, this pressure/vacuum generator can be used in any number of fluid (liquid and gas) systems (e.g., fluid recovery system, fluid transfer system, etc.)that require both a pressure source and a vacuum source while using a minimum number of components.

20 Claims, 9 Drawing Sheets





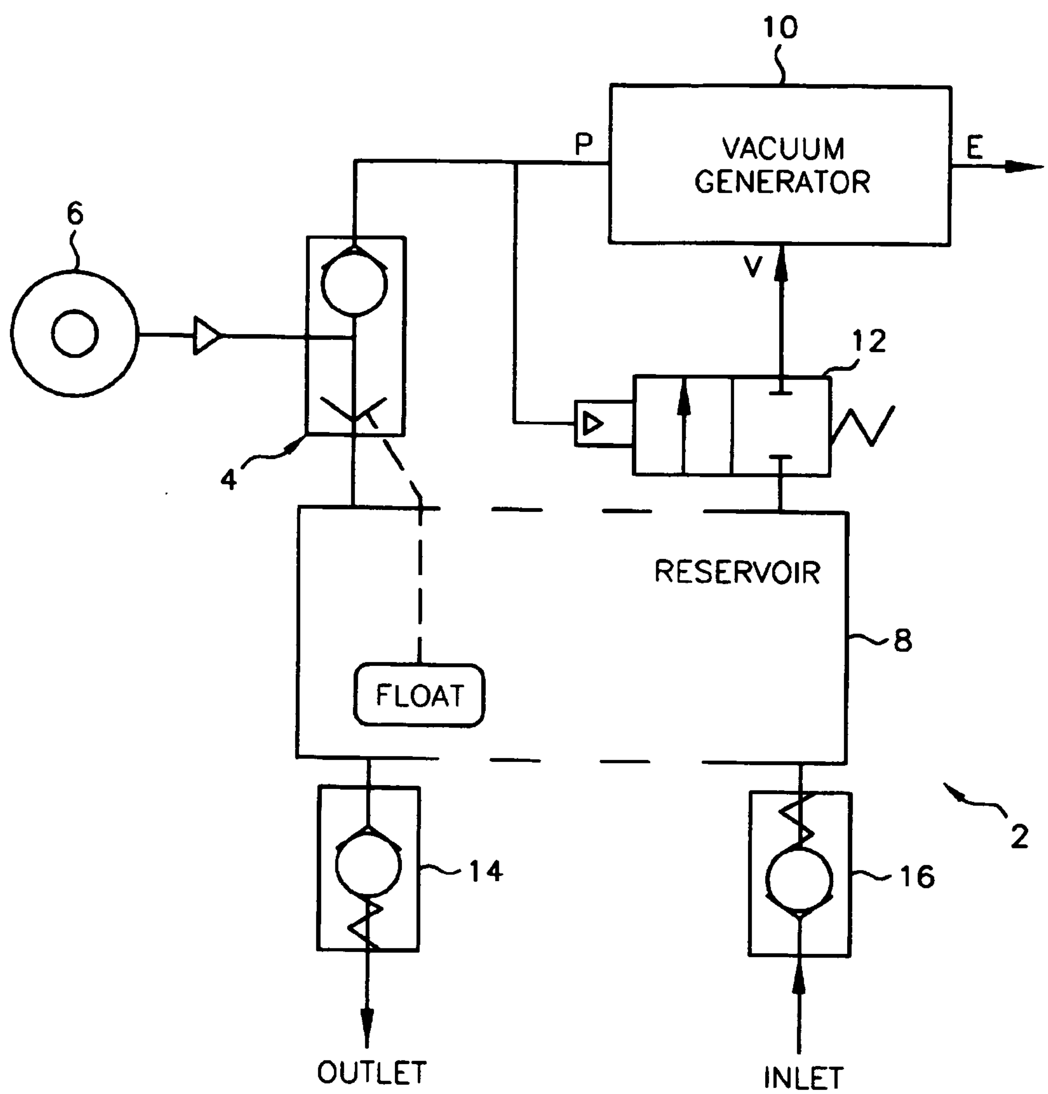


FIG. 1
(Prior Art)

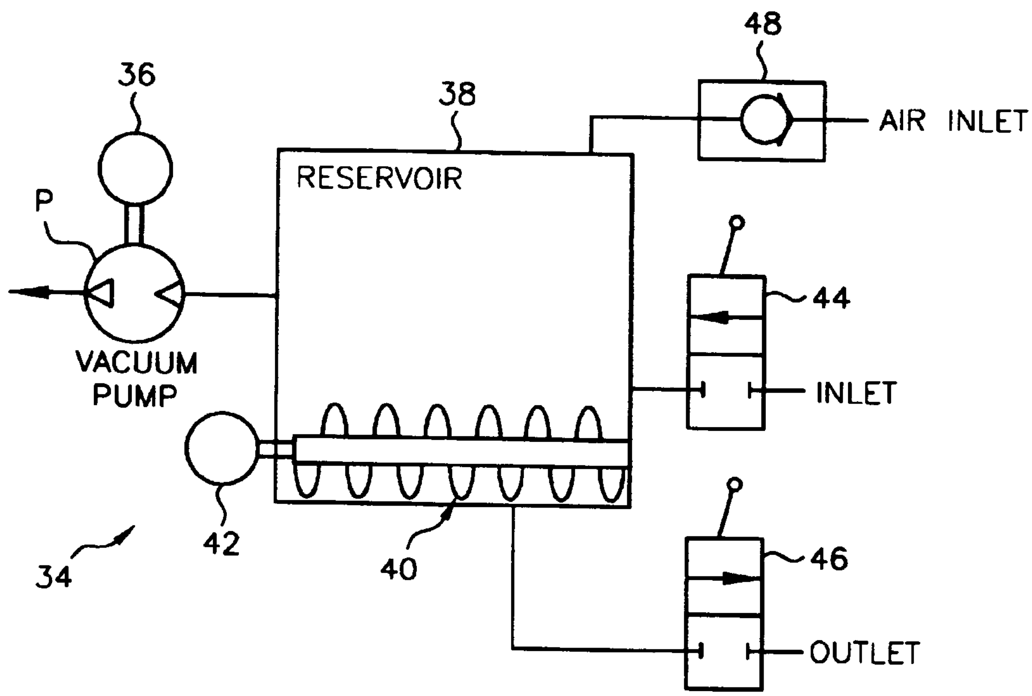


FIG. 2
(Prior Art)

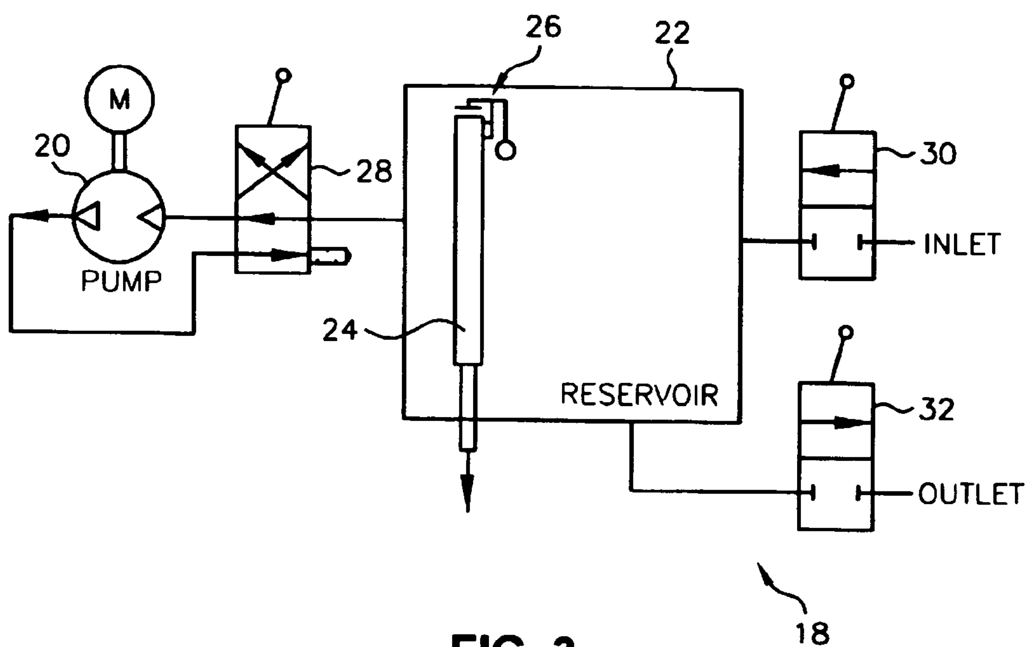


FIG. 3
(Prior Art)

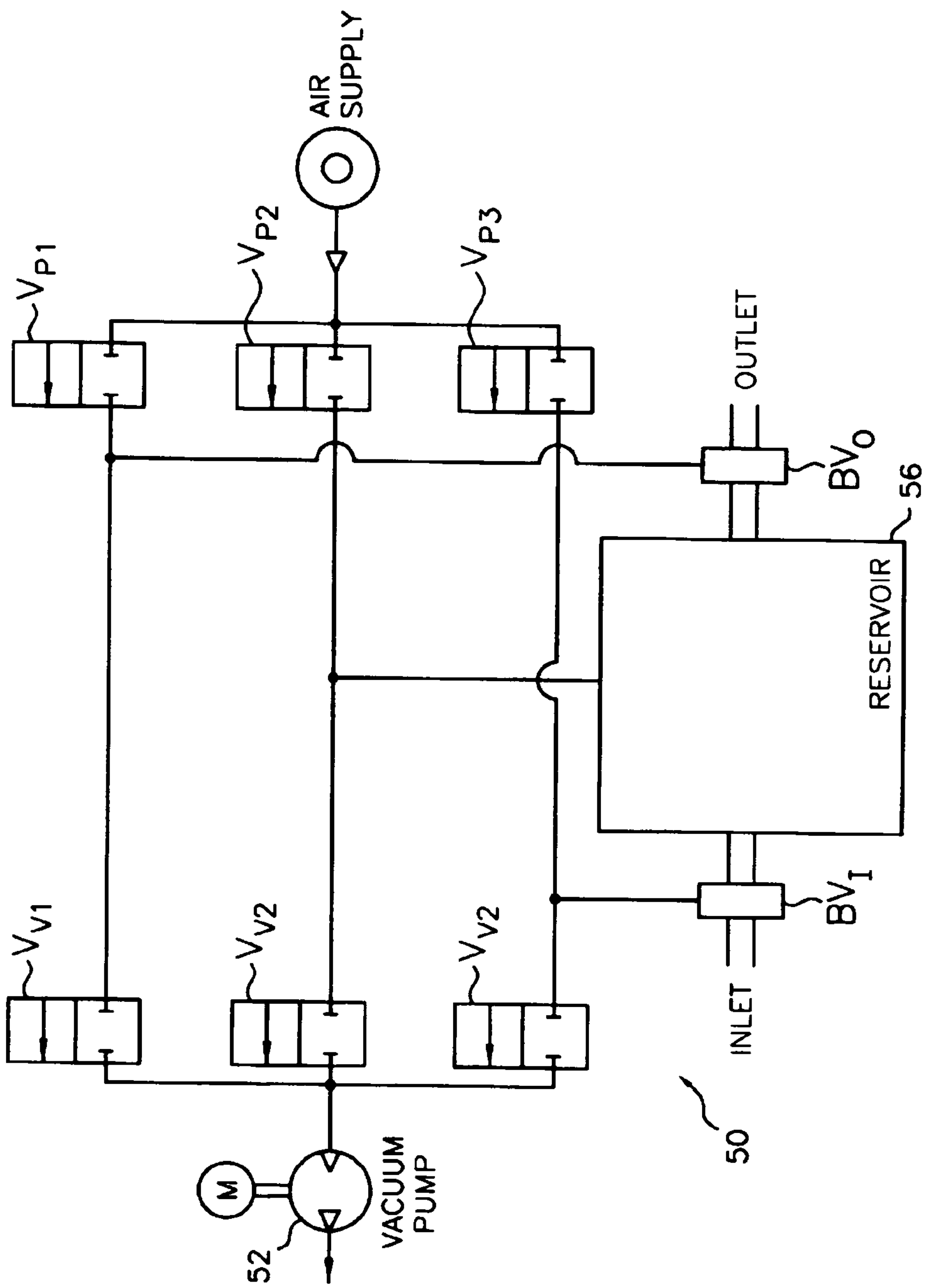


FIG. 4
(Prior Art)

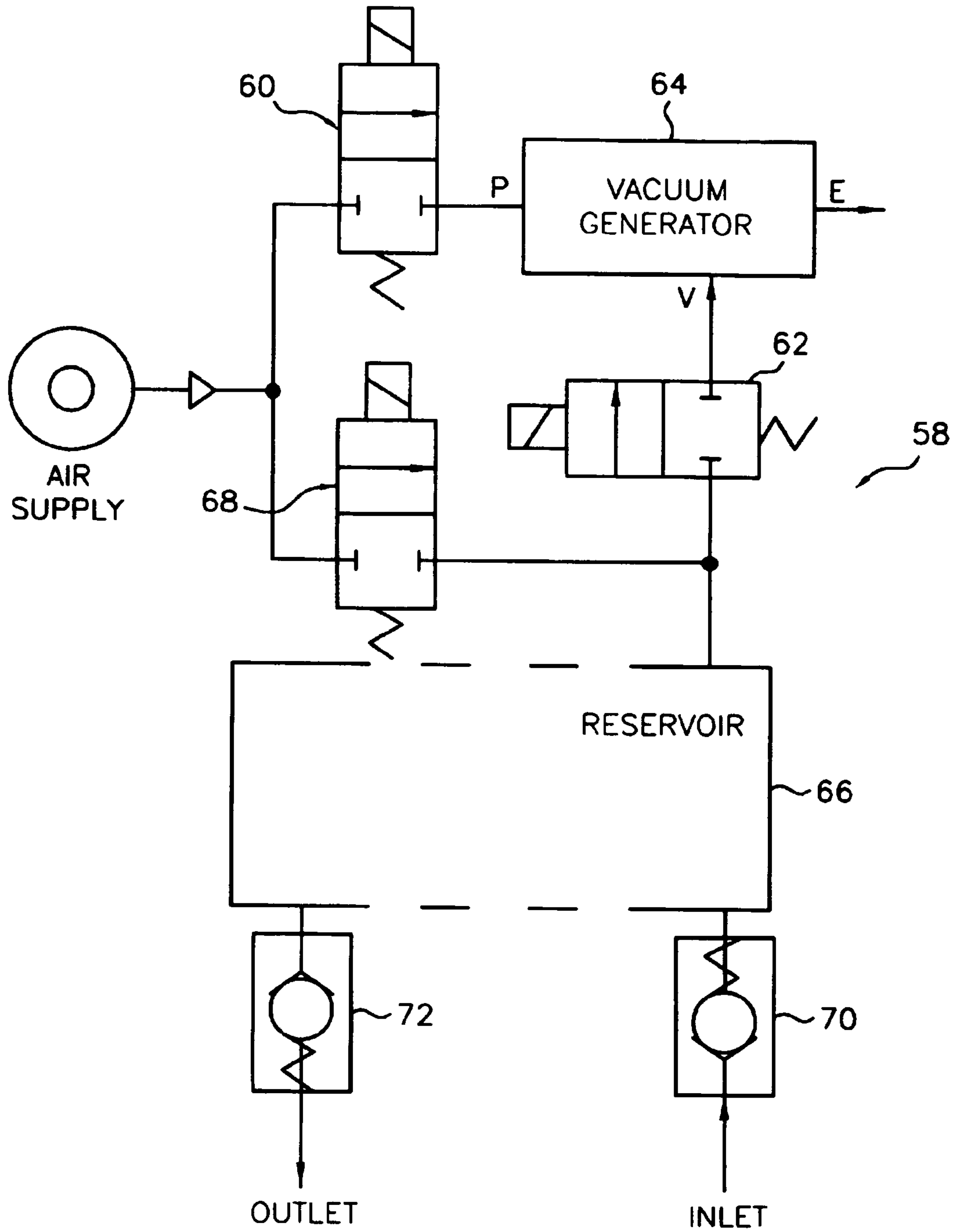


FIG. 5
(Prior Art)

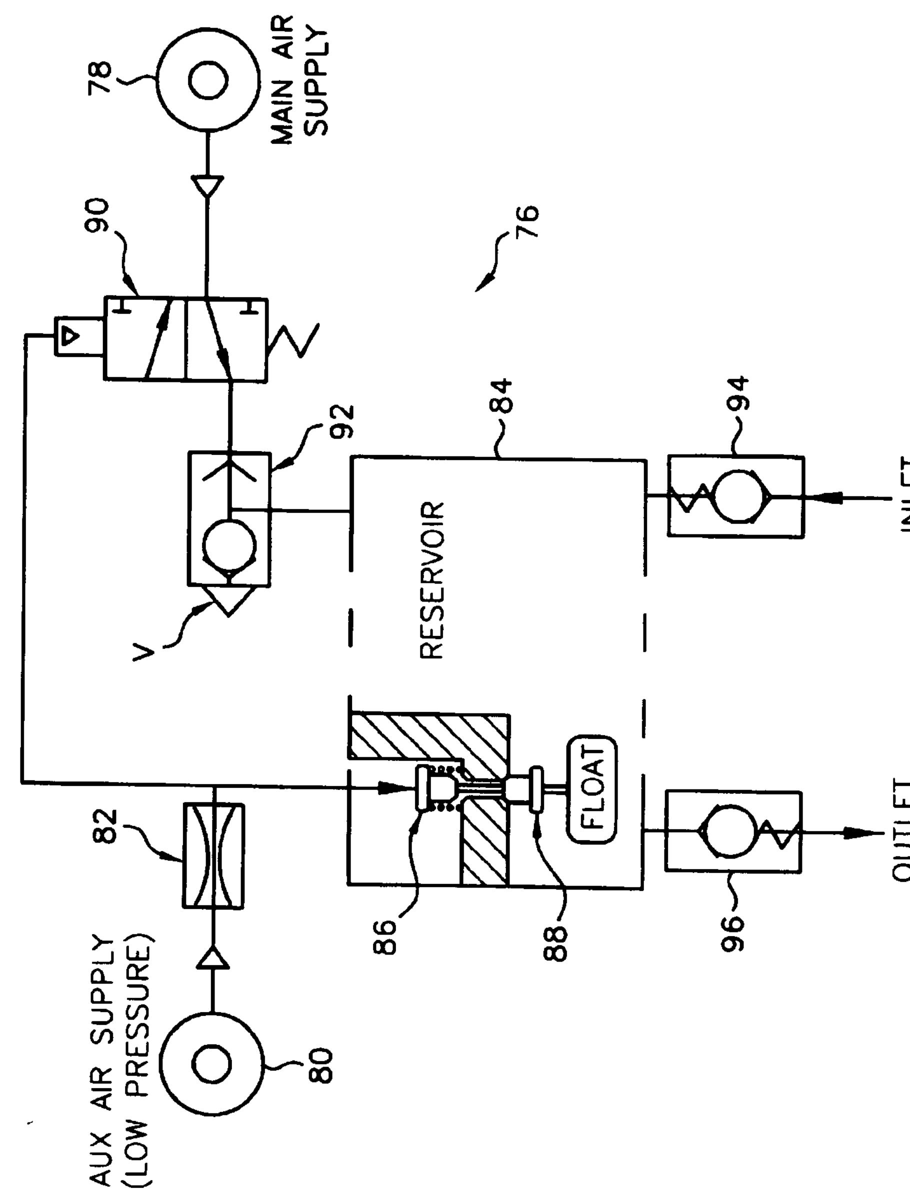


FIG. 6 (Prior Art)

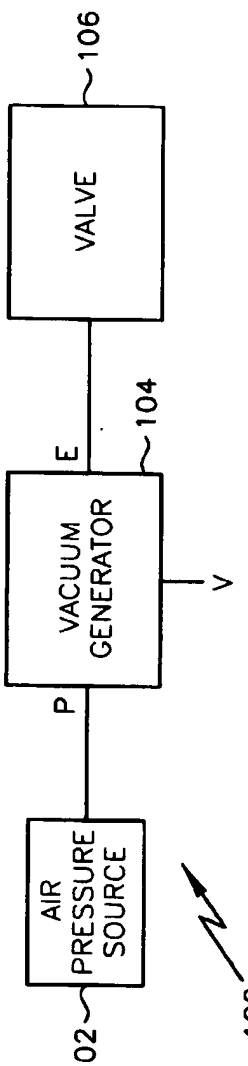


FIG. 7

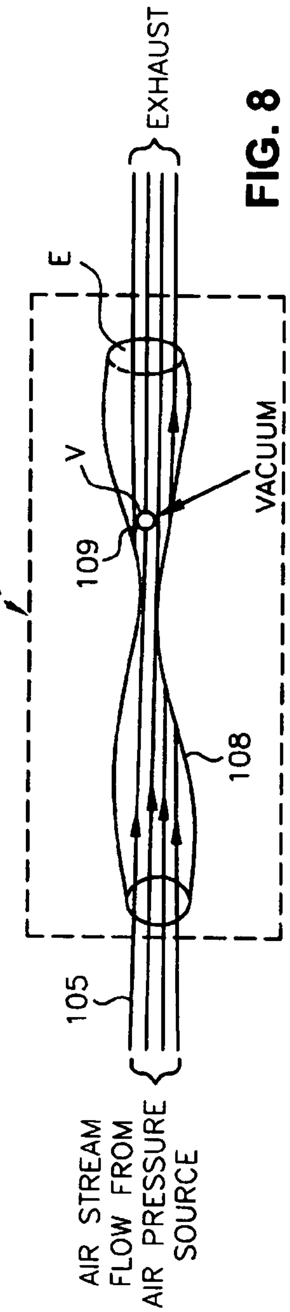


FIG. 8

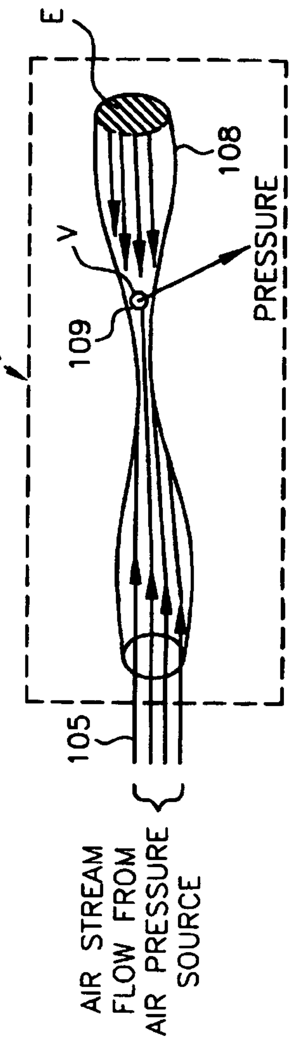
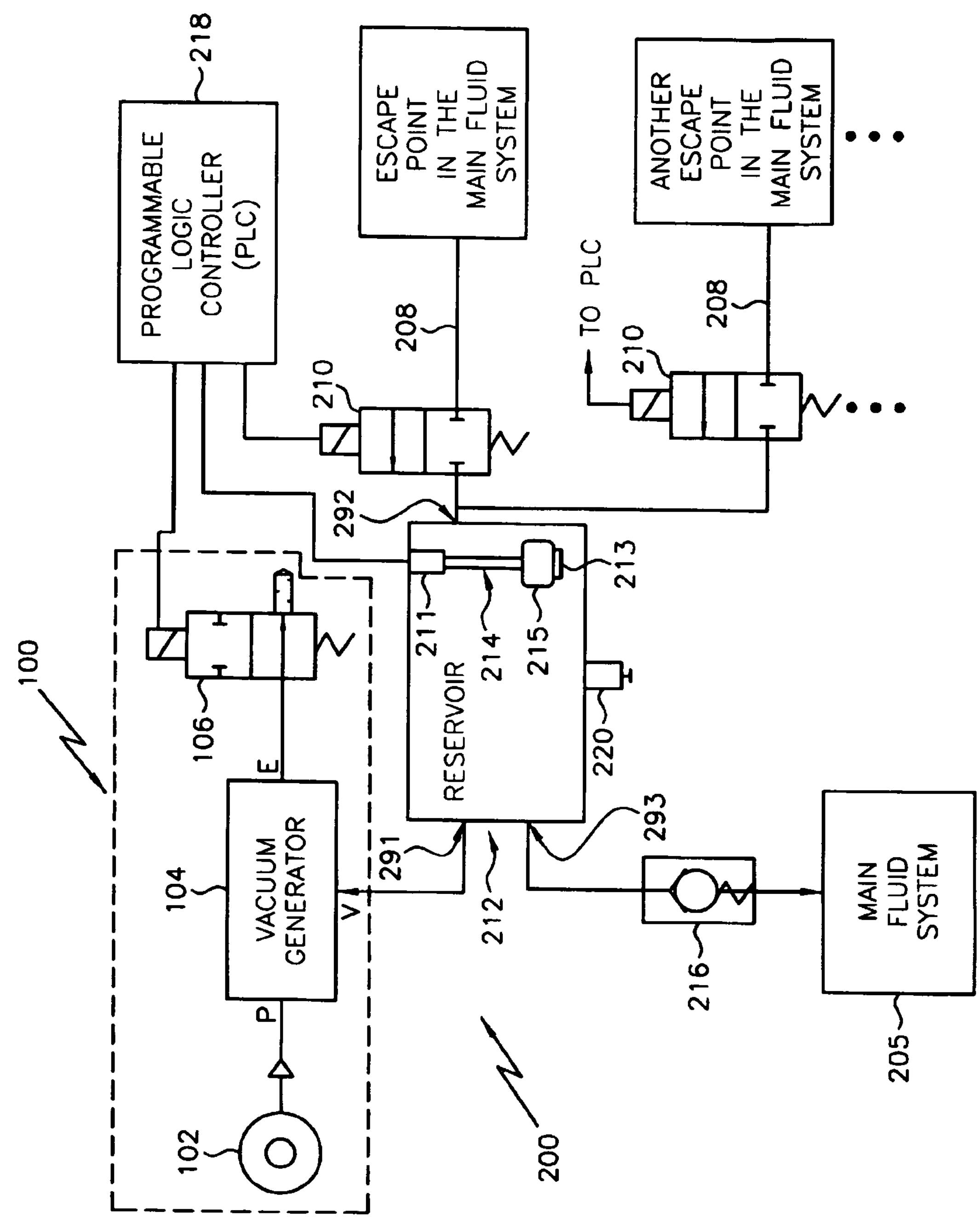


FIG. 9

FIG. 10


PROGRAMMABLE LOGIC CONTROLLER (PLC)
218
ESCAPE POINT IN THE MAIN FLUID SYSTEM
ANOTHER ESCAPE POINT IN THE MAIN FLUID SYSTEM
TO PLC
208
210
208
210
292
213
211
214
215
RESERVOIR
220
293
291
212
100
106
E
VACUUM GENERATOR
104
V
P
102
200
216
MAIN FLUID SYSTEM
205

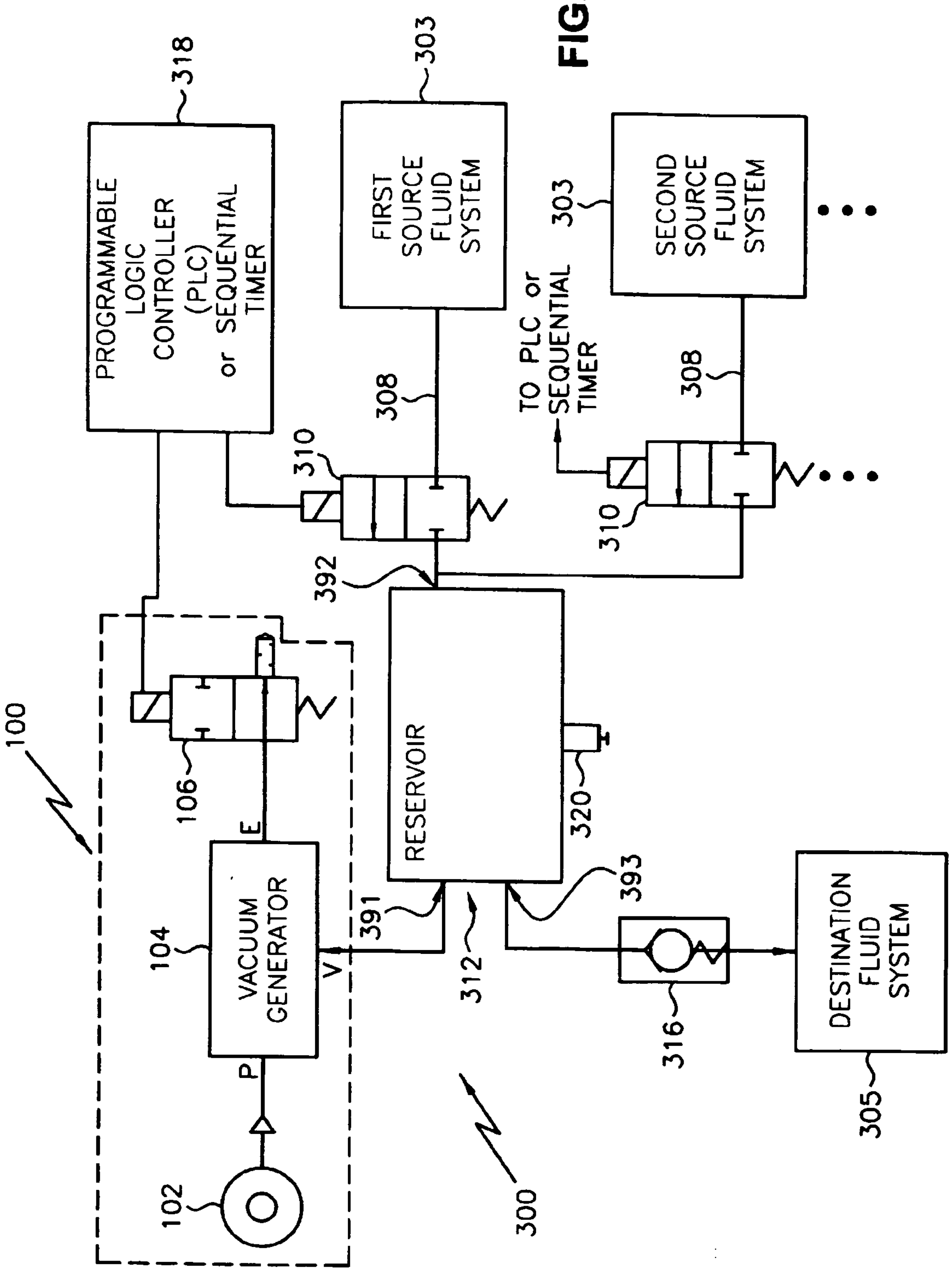

PROGRAMMABLE LOGIC CONTROLLER (PLC) or SEQUENTIAL TIMER
318
FIRST SOURCE FLUID SYSTEM
303
SECOND SOURCE FLUID SYSTEM
303
TO PLC or SEQUENTIAL TIMER
308
308
310
310
392
100
106
E
VACUUM GENERATOR
104
P
V
102
RESERVOIR
320
391
312
393
316
DESTINATION FLUID SYSTEM
305
300

FIG. 11

PRESSURE/VACUUM GENERATOR

FIELD OF THE INVENTION

The invention pertains to the field of fluid systems, and more particularly, to systems that require the use of both a pressure source and a vacuum source.

BACKGROUND OF INVENTION

In many fluid systems, there is a need to have both a pressure source (e.g., a pump) as well as a vacuum source (e.g., vacuum pump, vacuum generator, etc.). For example, in fluid recovery systems or fluid transfer systems, there is a need to collect a fluid from a first location (e.g., a main fluid system, a first fluid system, a fluid collection point) and move the fluid into a reservoir and then to evacuate the fluid from that reservoir either back to the main fluid system (i.e., a recovery system) or to a second fluid system (i.e., a transfer system). To accomplish this, a vacuum source draws the fluid into the reservoir and then a pressure source drives it out of the reservoir.

The following U.S. patents are various types of fluid systems using pressure sources and vacuum sources.

U.S. Pat. No. 2,400,651 (Marsh) discloses a liquid elevating system. A summary of the Marsh system **2** is shown in FIG. **1**. The Marsh system **2** uses a shuttle valve **4** between an air supply **6**, a reservoir **8** and a pressure inlet (P) of a vacuum generator **10**, as well as an air-operated valve **12** between the reservoir **8** and a vacuum inlet (V) of the vacuum generator **10**. A reservoir inlet check valve **16** and a reservoir outlet check valve **14** are also used. A float mechanism **20** inside the reservoir **8** controls the shuttle valve **4**.

U.S. Pat. No. 2,522,077 (Wahl) discloses a tank truck. A summary of the pumping system **34** used in the Wahl truck is shown in FIG. **2**. The pumping system **34** uses a pump (P, driven by a motor **36**) to draw a vacuum on a reservoir **38** to pull liquid in, and a mechanical screw **40** coupled to another motor **42** to pump it out. Manually-operated input **44** and output **46** valves are also used, as well as an air inlet check valve **48**. The system **34** is manually-operated.

U.S. Pat. No. 2,664,911 (Thompson) discloses a portable vacuum and pressure liquid tank truck. A summary of the pumping system **18** of the truck is shown in FIG. **3**. The pumping system **18** uses a pump **20** (driven by a motor, M) to draw a vacuum or pressurize a reservoir **22**; a separator **24** with a float valve **26** keeps fluid from getting into the pump **20**. The pump **20** action (vacuum, or pressure) is based on the position of a valve **28** that is manually controlled. Manually-operated input **30** and output **32** valves are also used.

U.S. Pat. No. 3,315,611 (Thompson) discloses a portable vacuum and pressure liquid tank truck, and uses a pumping system similar to the pumping system disclosed in U.S. Pat. No. 2,664,911 (Thompson) but adds an air bleeder to the system. The bleeder line draws air into the tank along with the liquid during the vacuum stage, thus eliminating foam. During the pressure stage, pressurized air is mixed with the liquid in the tank, making it easier to pump.

U.S. Pat. No. 4,770,610 (Breckner) discloses a frail material slurry pump system **50**. A summary of the Breckner system **50** is shown in FIG. **4**. This system **50** uses a vacuum pump **52** (driven by a motor M) and combination valving (V_{P1}–V_{P3}, V_{V1}–V_{V3}, BV_I and BV_O) to pull a vacuum on a reservoir **56** and uses a compressor (not shown, but forms a part of the air supply) with the combination valving

(V_{P1}–V_{P3}, V_{V1}–V_{V3}, BV_I and BV_O) to pressurize the reservoir **56**. The BV_I and BV_O valves are a bladder type to prevent damage to the frail material being pumped. This combination valving (V_{P1}–V_{P3} with V_{V1}–V_{V3}) controls the inlet BV_I and outlet BV_O bladder valves of the reservoir **56**.

U.S. Pat. No. 4,828,461 (Laempe) discloses an apparatus for metering flowable materials in sand core making machines. A summary of the pumping system **58** used therein is shown in FIG. **5**. The pumping system **58** works in a similar manner to the Marsh system **2** (FIG. **1**) but includes two shut-off valves, **60** and **62**, going into a vacuum generator **64**, whereby the shut-off valve **60** is coupled to the pressure port (P) of the vacuum generator **64** and the shut-off valve **62** is coupled to the vacuum port (V) of the vacuum generator **64**. In order to pressurize a reservoir **66**, the pumping system **58** uses a third shutoff valve **68** (for dividing the air supply, while closing the upper shut-off valve **60**). Reservoir inlet **70** and outlet **72** check valves are also used with the reservoir **66**.

U.S. Pat. No. 5,451,144 (French) discloses an air-operated pump system **76**. A summary of this pump system **76** is shown in FIG. **6**. The system **76** primarily uses gravity to draw liquid in, whereby a vaccum (V) is available as an option to assist gravity. The system **76** utilizes two sources of air pressure: a main air supply **78** and an auxiliary air supply **80**, the latter of which is fed to a reservoir **84** via flow restrictor **82**. Two poppet valves **86** and **88** are used. An air-operated three-way valve **90** is controlled by the poppet valves **86** and **88**. A quick-exhaust valve **92** is coupled between the three-way valve **90** and the reservoir **84**. Inlet **94** and outlet **96** check valves are also used with the reservoir **84**.

However, none of these references teach or suggest controlling the exhaust port of a vacuum generator for creating both a pressure source and a vacuum source.

OBJECTS OF THE INVENTION

Accordingly, it is the general object of this invention to provide an invention that overcomes the disadvantages of the prior art.

It is an object of the present invention to provide an apparatus, and a method for an apparatus, that can act as both a pressure source and a vacuum source.

It is an object of the present invention to provide an apparatus, and a method for an apparatus, that can act as both a pressure source and a vacuum source while utilizing a minimum number of components.

It is still yet a further object of the present invention to provide any liquid or gas system/method with an apparatus, and a method for an apparatus, that can act as both a pressure source and a vacuum source.

It is yet another object of the present invention to provide fluid recovery/transfer systems that utilize a minimum number of components.

It is still yet a further object of the present invention to provide fluid recovery/transfer systems that are less prone to problems.

SUMMARY OF THE INVENTION

These and other objects of the instant invention are achieved by providing, in a system requiring both a pressure source and a vacuum source, an improvement comprising: (a) a lumen (e.g., a Venturi tube) for conveying an air stream from an upstream port of the lumen toward a downstream port of the lumen wherein the lumen includes an orifice in

the surface of the lumen located between the upstream port and the downstream port and wherein the upstream port is coupled to an air pressure source (e.g., 70–150 psi air supply); (b) a valve coupled in fluid communication with the downstream port for opening and closing off the downstream port; and (c) the orifice pulling a vacuum whenever the valve is open and the orifice generating a positive pressure whenever the valve is closed.

These and other objects of the instant invention are also achieved by providing, in a system for recovering or transferring fluid from a first location to a second location, an improvement comprising: (a) a lumen (e.g., a Venturi tube) for conveying an air stream from an upstream port of the lumen toward a downstream port of the lumen wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port and wherein the upstream port is coupled to an air pressure source (e.g., 70–150 psi air supply); (b) a valve coupled in fluid communication with the downstream port for opening and closing off the downstream port; (c) a reservoir having a first port coupled in fluid communication to the orifice; and (d) wherein the orifice pulls a vacuum in the reservoir for drawing fluid from the first location through a second reservoir port whenever the valve is open and wherein the orifice pressurizes the reservoir to evacuate the fluid therein to the second location through a third reservoir port whenever the valve is closed.

These and other objects of the instant invention are also achieved by providing an automatic fluid recovery system for recovering fluid from a main fluid system having at least one escape point (e.g., a leak point, a collection point for accumulating fluid, etc.) and returning the escaping fluid to the main system. The fluid recovery system comprises: (a) a reservoir for collecting the escaping fluid and having a plurality of ports; (b) a first valve coupled in fluid communication between a first port of the reservoir and the at least one escape point; (c) a lumen (e.g., a Venturi tube) for conveying an air stream from an upstream port of the lumen toward a downstream port of the lumen wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port and wherein the upstream port is coupled to an air pressure source (e.g., 70–150 psi air supply); (d) a second valve coupled in fluid communication to the downstream port of the lumen; (e) controller means electrically coupled to the first valve and to the second valve; (f) means responsive to the level of the fluid collected in the reservoir and electrically coupled to the controller means for providing electrical signals indicative of the level of the fluid in the reservoir to the controller means; and (g) wherein the controller means controls the activation of the first valve and the second valve, based on the electrical signals, to fill the reservoir and then to evacuate the reservoir and wherein the evacuated fluid is returned to the main fluid system via a check valve coupled in fluid communication with a third port of the reservoir. These and other objects of the instant invention are also achieved by providing a automatic fluid transfer system for transferring fluid from at least one source fluid system having a predictable (e.g., predetermined, constant, etc.) flow to a destination fluid system. The fluid transfer system comprises: (a) a reservoir for receiving fluid from the at least one source fluid system and having a plurality of ports; (b) a first valve coupled in fluid communication between a first port of the reservoir and the at least one source fluid system; (c) a lumen (e.g., a Venturi tube) for conveying an air stream from an upstream port of the lumen toward a downstream port of the lumen wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port and wherein the upstream port is coupled to an air pressure source (e.g., 70–150 psi air supply); (d) a second valve coupled in fluid communication to the downstream port of the lumen; (e) controller means electrically coupled to the first valve and to the second valve; and (f) wherein the controller means controls the activation of the first valve and second valve to collect fluid from the at least one source fluid system into the reservoir and then to evacuate the reservoir, whereby the evacuated fluid is transferred to the destination fluid system via a check valve coupled in fluid communication with a third port of the reservoir.

These and other objects of the instant invention are also achieved by providing a method for establishing a pressure source and a vacuum source. The method comprises the steps of: (a) providing an air pressure source (e.g., 70–150 psi air supply) that delivers an air stream; (b) coupling a lumen (e.g., a Venturi tube) to the air pressure source whereby the lumen conveys the air stream from an upstream port of the lumen toward a downstream port of the lumen and wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port; (c) coupling a valve in fluid communication with the downstream port for opening and closing off the downstream port; (d) opening the valve to create a vacuum source at the orifice; and (e) closing the valve to create a pressure source at the orifice.

These and other objects of the instant invention are also achieved by providing a method for recovering or transferring fluid from a first location to a second location. The method comprises the steps of: (a) providing an air pressure source (e.g., 70–150 psi air supply) that delivers an air stream; (b) coupling a lumen (e.g., a Venturi tube) to the air pressure source whereby the lumen conveys the air stream from an upstream port of the lumen toward a downstream port of the lumen and wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port; (c) coupling a valve in fluid communication with the downstream port for opening and closing off the downstream port; (d) coupling a first port of a reservoir in fluid communication with the orifice; (e) opening the valve to draw fluid from the first location into the reservoir through a second reservoir port; and (f) closing the valve to evacuate the fluid in the reservoir to the second location through a third reservoir port.

These and other objects of the present invention are also achieved by providing a method for recovering escaping fluid (e.g., leaking fluid, accumulating fluid, etc.) from at least one escape point (e.g., a leak point, a collection point where accumulating fluid gathers) in a main fluid system and returning the escaping fluid thereto. The method comprises the steps of: (a) providing an air pressure source (e.g., 70–150 psi air supply) that delivers an air stream; (b) coupling a lumen (e.g., a Venturi tube) to the air pressure source whereby the lumen conveys the air stream from an upstream port of the lumen toward a downstream port of the lumen and wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port; (c) coupling a first valve in fluid communication with the downstream port for opening and closing off the downstream port; (d) coupling a first port of a reservoir in fluid communication with the orifice; (e) coupling a second port of the reservoir in fluid communication with a second valve that is in fluid communication with the at least one escape point; and (f) controlling the operation of the first valve and the second valve to collect

escaping fluid in the reservoir through the second port and then to return the collected fluid to the main fluid system through a third reservoir port.

These and other objects of the present invention are also achieved by providing a method for transferring fluid from at least one source fluid system having a predictable flow to a destination fluid system. The method comprises the steps of: (a) providing an air pressure source (e.g., 70–150 psi air supply) that delivers an air stream; (b) coupling a lumen (e.g., a Venturi tube) to the air pressure source whereby the lumen conveys the air stream from an upstream port of the lumen toward a downstream port of the lumen and wherein the lumen includes an orifice in the surface of the lumen located between the upstream port and the downstream port; (c) coupling a first valve in fluid communication with the downstream port for opening and closing off the downstream port; (d) coupling a first port of a reservoir in fluid communication with the orifice; (e) coupling a second port of the reservoir in fluid communication with a second valve that is in fluid communication with the at least one source fluid system; and (f) controlling the operation of the first valve and the second valve to collect fluid from the at least one source fluid system into the reservoir through the second port and then to transfer the collected fluid to the destination fluid system through a third reservoir port.

DESCRIPTION OF THE DRAWINGS

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a summary of a prior art pumping system, namely U.S. Pat. No. 2,400,651 (Marsh);

FIG. 2 is a summary of another prior art pumping system, namely U.S. Pat. No. 2,522,077 (Wahl);

FIG. 3 is a summary of another prior art pumping system, namely U.S. Pat. No. 2,664,911 (Thompson);

FIG. 4 is a summary of another prior art pumping system, namely U.S. Pat. No. 4,770,610 (Breckner);

FIG. 5 is a summary of another prior art pumping system, namely U.S. Pat. No. 4,828,461 (Laempe);

FIG. 6 is a summary of another prior art pumping system, namely U.S. Pat. No. 5,451,144 (French);

FIG. 7 is a block diagram of the present invention;

FIG. 8 is a functional diagram of the present invention with the exhaust port being in an open condition;

FIG. 9 is a functional diagram of the present invention with the exhaust port in a closed condition;

FIG. 10 is a block diagram of a first exemplary application of the present invention, known as a fluid recovery system (FRS); and

FIG. 11 is a block diagram of a second exemplary application of the present invention, known as a fluid transfer system (FTS).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in detail to the various figures of the drawing wherein like reference characters refer to like parts, there is shown at **100** in FIG. 7 a pressure/vacuum generator, which is assigned to Bijur Lubricating Corporation of Bennington, Vt.

The pressure/vacuum generator **100** comprises an air pressure source **102** (e.g., 70–150 psi air supply), a vacuum generator **104** (e.g., Bijur Part No. 27296) and a valve **106** (Bijur Part No. 27299). The air pressure source **102** is coupled to the pressure port (P) of the vacuum generator **104** and the valve **106** is coupled to the exhaust port (E) of the vacuum generator **104**. The valve **106** acts to either permit the exhaust port to be open to the atmosphere or to be closed to the atmosphere. FIGS. **8** and **9** are functional diagrams of the vacuum generator **104** with the valve **106** open (FIG. **8**) and with the valve **106** closed (FIG. **9**). As can be seen in FIGS. **8** and **9**, the vacuum generator **104** basically comprises a Venturi tube **108**; the vacuum port V comprises a small orifice **109** located just right of the center of the Venturi tube **108**. When the valve **106** is open and the air pressure source **102** is coupled to the pressure port (P) of the vacuum generator **104**, the air stream **105** creates a vacuum at the vacuum port V in accordance with the Bernoulli principle. However, when the valve **106** is closed, thereby blocking the exhaust port (E), the air stream **105** is forced through the small orifice **109**, thereby generating a positive pressure at the vacuum port V. None of the prior art teaches or suggests the control of the vacuum generator's **104** exhaust to establish both a pressure source and a vacuum source.

An exemplary application of the pressure/vacuum generator is shown in FIG. **10** which depicts a fluid recovery system (hereinafter "FRS") **200**. The FRS **200** is used as part of a main fluid system. The main fluid system (e.g., a lubrication system) comprises any number of devices that may be prone to leaks, including tubing, connectors, elbows, flanges, bearings, seals, gaskets, etc. (all of which are not shown). It is necessary to capture the leaking fluid and return it to the main fluid system.

Furthermore, in addition to restoring leaking fluid to a main fluid system, the FRS **200** also restores accumulated fluid back to the main fluid system. For example, the main fluid system in a punch press machine may intentionally overlubricate the slides/ways of the machine. As a result, an accumulation of that lubricant occurs at an accumulation point or a collection point (e.g., a collection tray). The FRS **200**, being coupled to the accumulation/collection point, also restores the accumulated fluid back to the main fluid system. Thus, it is within the broadest scope of the FRS **200** that the term "escape", "escaping", etc. as used throughout this application covers both leaking fluid (i.e., unintentional egress of fluid from the main fluid system) and accumulating fluid (i.e., intentional egress of fluid, at an accumulation point or a collection point, from the main fluid system) which cannot otherwise re-enter the main fluid system without the FRS **200**.

The escaping fluid is captured in a conduit, lumen, collection tray, etc. (indicated by reference number **208**) that is connected to, or around, these escape points (not shown). This conduit **208** is in fluid connection with the inlet to the FRS **200**. In particular, the conduit **208** is coupled to a vacuum valve **210** (e.g., Bijur Part Nos. 27300/27310). The vacuum valve **210** has an outlet coupled to a reservoir **212** (e.g., Bijur Part No. 27275). At a resevoir part **292** the reservoir **212** comprises a means **214** responsive to the level of the fluid being collected in the reservoir **212**; an example of such a means is an ultrasonic level detector (not shown), or any other type of level detection that provides a signal responsive to the level. In one embodiment, a liquid dual-level switch (e.g., Bijur Part No. 27301, 24 volts DC switch, 0.5 amps$_{max}$) is used. The liquid dual-level switch comprises an upper switch **211**, a lower switch **213** and a magnetic float **215**; when the reservoir **212** is empty, the magnetic float **215** and the lower switch **213** are electromagnetically coupled,

and the lower switch **213** outputs an "empty" signal; when the reservoir **212** is full, the magnetic float **215** and the upper switch **211** are electromagnetically coupled, and the upper switch **211** outputs a "full" signal. The reservoir **212**, at another reservoir port **291** is also in fluid communication with the vacuum port (V) of the vacuum generator **104**. The reservoir **212**, at another port **293** is also in fluid communication with an outlet check valve **216** (e.g., Bijur Part No. 27302). The outlet check valve **216** is in fluid communication with the main fluid system. A programmable logic controller (PLC) **218** (e.g., IDEC Micro-1 PLC, Type FC1A4E, Base **24** manufactured by IDEC Izumi Corp. of Japan, or any properly configured logic device, e.g., a microprocessor, a microcontroller, etc.) is electrically coupled to the solenoids of the vacuum valve **210** and the valve **106**), as well as to the means **214** responsive to the level of the fluid being collected (hereinafter the "level means **214**") in the reservoir **212**. A drain **220** is provided in the reservoir **212** for maintenance purposes.

Operation of the FRS **200** is as follows. To collect escaping fluid from the escape point(s), the PLC **218** de-energizes the valve **106** (thereby opening the valve to permit exhaust) while energizing the vacuum valve **210** (opening the valve **210**). This action causes a vacuum to be drawn in the reservoir **212**. The result is that escaping fluid from the main fluid system is drawn into the reservoir **212** through the vacuum valve **210**. As fluid is drawn in and when the fluid level causes the magnetic float **215** to be adjacent the upper switch **211**, the liquid dual-level switch outputs the "full" signal to the PLC **218**, thereby causing the PLC **218** to de-energize the vacuum valve **210** (closing the vacuum valve **210**) while energizing the valve **106**. Energizing the valve **106**, closes off the exhaust port, E, of the vacuum generator **104** which, as discussed above, converts the vacuum port, V, into a pressure port. This action pushes the collected fluid out of the reservoir **212**, through the outlet check valve **216** and back to the main fluid system **205** (or even to a liquid waste container, not shown). As the fluid leaves the reservoir **212**, the magnetic float **215** falls; when the magnetic float **215** is adjacent to the lower switch **213**, the "empty" signal is transmitted to the PLC **218** which then de-energizes the valve **106** and re-energizes the vacuum valve **210**. This cycle is then repeated.

It should be understood that a plurality of conduits, lumens, collection points, etc. (indicated by reference number **208**) from various escape points in the main fluid system, each with a respective vacuum valve **210**, can be coupled to the reservoir **212**; each vacuum valve **210** is also electrically coupled to the PLC **218**. Thus, the PLC **218** can control each vacuum valve **210** in sequence (e.g., activate one vacuum valve **210** for **10** seconds while keeping all other vacuum valves **210** closed; then shutting off that vacuum valve while opening another vacuum valve **210**, and repeating the cycle).

It should also be understood that only a single pressure/vacuum generator **100** and reservoir (e.g., reservoir **212** or **312**) are required to service a multiplicity of vacuum valves (e.g., vacuum valves **210** or **310**), as shown in FIGS. **10–11**.

It should also be understood that the level means **214** in the FRS **200** covers all types of mechanisms that couple the level of the fluid collected in the reservoir **212** to the valve **106** and the vacuum valve **210**. In other words, as shown, the level means **214** provides an electrical signal to the PLC **218** which, in turn, controls the respective solenoids of the valve **106** and the vacuum valve **210** at the appropriate times. However, it is within the broadest scope of the FRS **200** that the level means **214** includes a direct interface with the valve **106** and the vacuum valve **210** so that movement of the level means **214** closes/opens the valve **106** while closing/opening the vacuum valve **210**.

Another exemplary application of the pressure/vacuum generator is shown in FIG. **11** which depicts an automatic fluid transfer system (hereinafter "FTS" **300**). The FTS **300** is similar to the FRS **200**, except that the FTS **300** involves transferring a source fluid from a source fluid system **303**, having a predictable (e.g., predetermined, constant, etc.) flow, to a destination fluid system **305**. Since the flow of the source fluid system **303** is predictable, there is no need to monitor the level of the fluid collecting in the reservoir **312**. As a result, the PLC **318** (or sequential timer, or other timing devices) can operate on a timing basis rather than having to sense the reservoir **312** fluid level. Other than that, the components of the FTS **300** correspond to the components of the FRS **200**, whereby the reference numbers beginning with "3—" are the same for those reference numbers beginning with "2—". Furthermore, as shown in FIG. **11**, the FTS **300** can operate using a plurality of source fluid systems **303** (each having a predictable, e.g., predetermined, constant, etc., flow) for transferring source fluids from each of their respective source fluid systems to the destination fluid system **305**.

The important aspect of the pressure/vacuum generator **100** is the automatic valving of the exhaust port, E, of the vacuum generator **104**. Valving the exhaust port permits the use of a single source to act as both the "puller" and "pusher" of a fluid while using only a single valve (**106**). This increases the reliability of any system (e.g., the FRS **200**/FTS **300**) which uses the pressure/vacuum generator **100** by decreasing the number of components that can fail while reducing the cost of the fluid systems' operation. Thus, it should be understood that the present invention **100** has an unlimited number of applications and that the FRS **200** and the FTS **300** discussed above are only by way of example.

It should be understood that the term "fluid" used throughout the present application includes both liquids and gases and therefore the pressure/vacuum generator **100**, as well as the FRS **200** and FTS **300**, discussed above, can all be implemented for gas systems also. In addition, the term "automatic" used throughout the present application identifies that there is no manual operation involved in order for the FRS **200** or the FTS **300** to operate.

It should also be understood that where the valves depicted in the present application use electric solenoid control, other types of control (e.g., pneumatically-controlled valves) are also covered by the broadest scope of this invention.

Without further elaboration, the foregoing will so fully illustrate my invention that others may, by applying current or future knowledge, readily adopt the same for use under various conditions of service.

I claim:

1. In a system for recovering or transferring fluid from a first location to a second location, the improvement comprising:

(a) a lumen for conveying an air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port, said upstream port being coupled to an air pressure source;

(b) a valve coupled in fluid communication with said downstream port for opening and closing off said downstream port;

(c) a reservoir having a first port coupled to said orifice; and

(d) said orifice pulling a vacuum in said reservoir for drawing fluid from the first location through a second reservoir port whenever said valve is open and said orifice pressurizing said reservoir to evacuate the fluid therein to the second location through a third reservoir port whenever said valve is closed, said lumen not being exposed to the fluid.

2. The improvement of claim 1 wherein said lumen comprises a Venturi tube.

3. An automatic fluid recovery system for recovering fluid from a main fluid system having at least one escape point and returning the escaping fluid to the main system, said fluid recovery system comprising:

(a) a reservoir for collecting the escaping fluid and having a first port, a second port and a third port;

(b) a first valve coupled in fluid communication between said first port of said reservoir and the at least one escape point;

(c) a lumen for conveying an air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port, said upstream port being coupled to an air pressure source, and said orifice being coupled to said second reservoir port, said lumen not being exposed to the fluid;

(d) a second valve coupled in fluid communication to said downstream port of said lumen;

(e) controller means electrically coupled to said first valve and to said second valve;

(f) means responsive to the level of the fluid collected in said reservoir electrically coupled to said controller means for providing electrical signals indicative of the level of the fluid in said reservoir to said controller means; and

(g) wherein said controller means controls the activation of said first valve and said second valve, based on said electrical signals, to fill said reservoir and then to evacuate said reservoir, said evacuated fluid being returned to said main fluid system via a check valve coupled in fluid communication with said third port of said reservoir.

4. The fluid recovery system of claim 3 wherein said first valve is normally closed and is opened when activated by said controller means.

5. The fluid recovery system of claim 3 wherein said second valve is normally open and is closed when activated by said controller means.

6. The fluid recovery system of claim 3 wherein said lumen comprises a Venturi tube.

7. The fluid recovery system of claim 3 wherein said level detecting means responsive to said level of the fluid collected in said reservoir is a fluid dual-level switch that comprises:

(a) float portion that floats on the fluid collected in said reservoir;

(b) an upper switch portion which, when electromagnetically coupled to said float portion, generates a first electrical signal to said controller means indicative of a full reservoir; and

(c) a lower switch portion which, when electromagnetically coupled to said float portion, generates a second electrical signal to said controller means indicative of an empty reservoir.

8. An automatic fluid transfer system for transferring fluid from at least one source fluid system having a predictable flow to a destination fluid system, said fluid transfer system comprising:

(a) a reservoir for receiving fluid from the at least one source fluid system and having a first port, a second port and a third port;

(b) a first valve coupled in fluid communication between said first port of said reservoir and the at least one source fluid system;

(c) a lumen for conveying an air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port, said upstream port being coupled to an air pressure source, and said orifice being coupled to said second reservoir port;

(d) a second valve coupled in fluid communication to said downstream port of said lumen;

(e) controller means electrically coupled to said first valve and to said second valve; and

(f) wherein said controller means controls the activation of said first valve and said second valve to collect fluid from the at least one source fluid system into said reservoir and then to evacuate said reservoir, said evacuated fluid being transferred to the destination fluid system via a check valve coupled in fluid communication with said third port of said reservoir, said lumen not being exposed to the fluid.

9. The fluid recovery system of claim 8 wherein said first valve is normally closed and is opened when activated by said controller means.

10. The fluid recovery system of claim 8 wherein said second valve is normally open and is closed when activated by said controller means.

11. The fluid recovery system of claim 8 wherein said lumen comprises a Venturi tube.

12. A method for recovering or transferring fluid from a first location to a second location, said method comprising the steps of:

(a) providing an air pressure source that delivers an air stream;

(b) coupling a lumen to said air pressure source, said lumen conveying said air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port;

(c) coupling a valve in fluid communication with said downstream port for opening and closing off said downstream port;

(d) coupling a first port of a reservoir to said orifice without exposing said lumen to the fluid;

(e) opening said valve to draw fluid from the first location into said reservoir through a second reservoir port; and

(f) closing said valve to evacuate the fluid in said reservoir to the second location through a third reservoir port.

13. The method of claim 12 wherein said lumen comprises a Venturi tube.

14. A method for recovering escaping fluid from at least one escape point in a main fluid system and returning the escaping fluid thereto, said method comprising the steps of:

(a) providing an air pressure source that delivers an air stream;

(b) coupling a lumen to said air pressure source, said lumen conveying said air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port;

(c) coupling a first valve in fluid communication with said downstream port for opening and closing off said downstream port;

(d) coupling a first port of a reservoir to said orifice without exposing said lumen to the fluid;

(e) coupling a second port of said reservoir in fluid communication with a second valve that is in fluid communication with the at least one escape point; and

(f) controlling the operation of said first valve and said second valve to collect escaping fluid in said reservoir through said second port and then to return the collected fluid to the main fluid system through a third reservoir port.

15. The method of claim 14 wherein said step of controlling the operation of said first valve and said second valve comprises:

(a) opening said first and second valves to draw fluid from the at least one escape point into said reservoir through said second reservoir port;

(b) detecting the level of fluid collecting in said reservoir;

(c) closing said first and second valves, whenever the detected level is full in said reservoir, to evacuate the fluid in said reservoir through said third reservoir port to return the escaping fluid the main fluid system;

(d) opening said first and second valves whenever the detected level is empty in said reservoir; and

(e) repeating steps (a)–(d).

16. The method of claim 15 wherein said step of detecting the level of fluid collecting in said reservoir comprises:

(a) providing a valve controller for controlling said first and second valves;

(b) providing a first electrical switch adjacent the bottom of said reservoir;

(c) providing a second electrical switch adjacent the top of said reservoir;

(d) providing a magnetic float that is moved by the fluid collecting in said reservoir wherein said magnetic float electromagnetically couples to said first electrical switch when said reservoir is empty and wherein said magnetic float electromagnetically couples to said second electrical switch whenever said reservoir is full;

(e) transmitting a first electrical signal to said valve controller whenever said first electrical switch is electromagnetically coupled to said magnetic float and transmitting a second electrical signal to said valve controller whenever said second electrical switch is electromagnetically coupled to said magnetic float.

17. The method of claim 14 wherein said lumen comprises a Venturi tube.

18. A method for transferring fluid from at least one source fluid system having a predictable flow to a destination fluid system, said method comprising the steps of:

(a) providing an air pressure source that delivers an air stream;

(b) coupling a lumen to said air pressure source, said lumen conveying said air stream from an upstream port of said lumen toward a downstream port of said lumen, said lumen including an orifice in the surface of said lumen located between said upstream port and said downstream port;

(c) coupling a first valve in fluid communication with said downstream port for opening and closing off said downstream port;

(d) coupling a first port of a reservoir to said orifice without exposing said lumen to the fluid;

(e) coupling a second port of said reservoir in fluid communication with a second valve that is in fluid communication with the at least one source fluid system; and

(f) controlling the operation of said first valve and said second valve to collect fluid from the at least one source fluid system into said reservoir through said second port and then to transfer the collected fluid to the destination fluid system through a third reservoir port.

19. The method of claim 18 wherein said step of controlling the operation of said first valve and said second valve comprises:

(a) opening said first and second valves to draw fluid from the at least one source fluid system into said reservoir through said second reservoir port;

(b) closing said first and second valves to evacuate the fluid in said reservoir through said third reservoir port to transfer the fluid to the destination fluid system;

(c) opening said first and second valves; and

(d) repeating steps (a)–(c).

20. The method of claim 18 wherein said lumen comprises a Venturi tube.

* * * * *

(C) Prior Art submitted by Applicant - Entered

The following items (1) – (42) listed below are hereby entered as evidence submitted to the Examiner as noted.

(1) Copy of US Patent Number 2346728 ("Carlson"). This evidence was entered into the record by the Applicant on 10/24/2003.

(2) Copy of US Patent Number 2514059 ("Hicks et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(3) Copy of US Patent Number 3467301 ("Doyle et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(4) Copy of US Patent Number 3623500 ("Hoy"). This evidence was entered into the record by the Applicant on 10/24/2003.

(5) Copy of US Patent Number 3712331 ("Otto"). This evidence was entered into the record by the Applicant on 10/24/2003.

(6) Copy of US Patent Number 3730228 ("Gibbs, Sr."). This evidence was entered into the record by the Applicant on 10/24/2003.

(7) Copy of US Patent Number 3811462 ("Feliz"). This evidence was entered into the record by the Applicant on 10/24/2003.

(8) Copy of US Patent Number 3882565 ("Irwin et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(9) Copy of US Patent Number 3958297 ("Hukuba et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(10) Copy of US Patent Number 4133347 ("Mercer"). This evidence was entered into the record by the Applicant on 10/24/2003.

(11) Copy of US Patent Number 4180102 ("Larkin"). This evidence was entered into the record by the Applicant on 10/24/2003.

(12) Copy of US Patent Number 4223702 ("Cook"). This evidence was entered into the record by the Applicant on 10/24/2003.

(13) Copy of US Patent Number 4231595 ("Knutsen"). This evidence was entered into the record by the Applicant on 10/24/2003.

(14) Copy of US Patent Number 4650224 ("Smith"). This evidence was entered into the record by the Applicant on 10/24/2003.

(15) Copy of US Patent Number 4779650 ("Sargent et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(16) Copy of US Patent Number 4796926 ("Rapsilver"). This evidence was entered into the record by the Applicant on 10/24/2003.

(17) Copy of US Patent Number 4854349 ("Foreman"). This evidence was entered into the record by the Applicant on 10/24/2003.

(18) Copy of US Patent Number 5023959 ("Mercer"). This evidence was entered into the record by the Applicant on 10/24/2003.

(19) Copy of US Patent Number 5078180 ("Collins"). This evidence was entered into the record by the Applicant on 10/24/2003.

(20) Copy of US Patent Number 5244003 ("Boomgaarden"). This evidence was entered into the record by the Applicant on 10/24/2003.

(21) Copy of US Patent Number 5247974 ("Sargent et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(22) Copy of US Patent Number 5636648 ("O'Brien et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(23) Copy of US Patent Number 5653262 ("Hanemaayer"). This evidence was entered into the record by the Applicant on 10/24/2003.

(24) Copy of US Patent Number 5697285 ("Nappi et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(25) Copy of US Patent Number 5816639 ("DiBiagio et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(26) Copy of US Patent Number 5823869 ("Paturzo"). This evidence was entered into the record by the Applicant on 10/24/2003.

(27) Copy of US Patent Number 5904183 ("Leech"). This evidence was entered into the record by the Applicant on 10/24/2003.

(28) Copy of US Patent Number 5951082 ("DiBiagio et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(29) Copy of US Patent Number 5988221 ("Walker"). This evidence was entered into the record by the Applicant on 10/24/2003.

(30) Copy of US Patent Number 6024134 ("Akedo et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(31) Copy of US Patent Number 6607009 B2 ("Schoellhorn et al."). This evidence was entered into the record by the Applicant on 10/24/2003.

(32) Copy of NPL: ARIZONA VORTEX TUBE MANUFACTURING COMPANY, Title "Vortex Air Amplifiers", from http://www.arizoniavortex.com/airamplifiers.htm, 8/25/03, 2

pages, Sedoma, AZ USA. This evidence was entered into the record by the Applicant on 10/24/2003.

(33) Copy of NPL: EXAIR CORP., Title "Air Amplifiers", from http://www.exair.com/airamplifier/aa_page.htm, 8/6/03, 4 pages, Cincinnati, OH USA. This evidence was entered into the record by the Applicant on 10/24/2003.

(34) Copy of NPL: EXAIR CORP., Title "Line Vac", from http://www.exair.com/linevac/lv_page.htm, 8/6/03, 7 pages, Cincinnati, OH USA. This evidence was entered into the record by the Applicant on 10/24/2003.

(35) Copy of NPL: FOX VALVE DEVELOPMENT CORP., Title "Applications of Fox Venturi Eductors Case Study No. 31", from http://www.foxvalve.com/pdf/case_studies/Fox_cs31.pdf, 8/03, 2 pgs, Dover, NJ USA. This evidence was entered into the record by the Applicant on 10/24/2003.

(36) Copy of NPL: RICHARD LINDSTOM, M.D., "Advances in Opthalmic Technology", Nov. 12, 2001, 3 pgs, Staar Surgical 2001 AAO Education Program, STAAR Surgical Company Monrovia, CA USA. This evidence was entered into the record by the Applicant on 10/24/2003.

(37) Copy of NPL: COM GROUP, "Air Pumps, Dragin Pump, BV22 & BV11", from http://www.zicom.com.sg/html/blovac.html, 8/5/03, 2 pgs, Singapore. This evidence was entered into the record by the Applicant on 10/24/2003.

(38) Copy of US Patent Application 2002/079017 A1 ("Fields"). This evidence was entered into the record by the Applicant on 07/27/2004.

(39) Copy of US Patent Number 5023959 ("Mercer"). This evidence was entered into the record by the Applicant on 07/27/2004.

(40) Copy of US Patent Number 4779650 ("Sargent et al."). This evidence was entered into the record by the Applicant on 07/27/2004.

(41) Copy of US Patent Number 4133347 ("Mercer"). This evidence was entered into the record by the Applicant on 07/27/2004.

(42) Copy of US Patent Number 2852216 ("Peters"). This evidence was entered into the record by the Applicant on 07/27/2004.

Copies of References (1) – (31) and (38) – (42) previously submitted above at:

(B) Evidence for Claims 1-24 – Entered:.

Copies of References (32) – (37) follows.

Arizona Vortex Tube Manufacturing Company

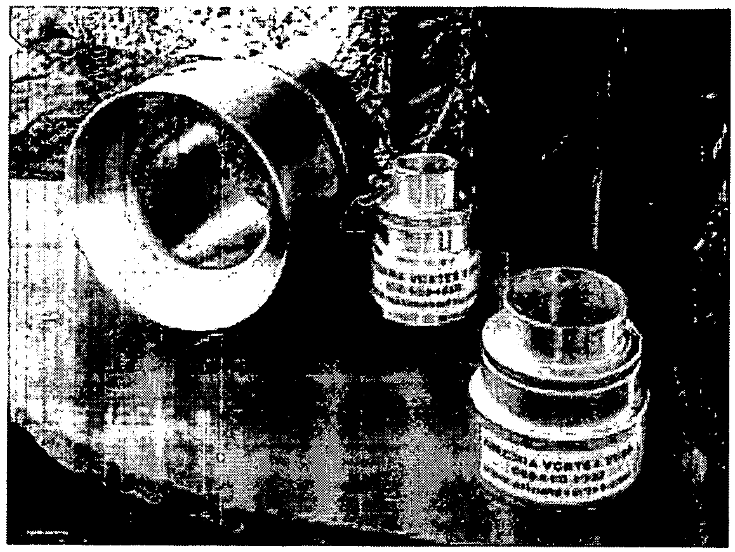
DIRECT TO YOU! CALL FREE — 1-800-660-4060

VORTEX AIR AMPLIFIERS

AIR COOL, CONVEY MATERIALS, DRY PRODUCTS, VENTILATE CHAMBERS
ALUMINUM/STAINLESS STEEL CONSTRUCTION

WHAT ARE VORTEX AIR AMPLIFIERS?

\ Vortex Air Amplifier utilizes a small amount of ompressed air to create larger volumes of air, as nuch as 25x amplification. The total volume and he volume of compressed air is infinitely adjustable. Vortex Air Amplifiers are used to eplace straight compressed air fans and blowers n countless applications. Vortex Air Amplifiers do not have the drawbacks of fans and blowers equiring guards for blowers and the bulk of blowers. Vortex Air Amplifiers have excellent vacuum characteristics which make them perfect or air conveying and exhausting of fumes.



HOW DO VORTEX AIR AMPLIFIERS WORK?

\ small amount of compressed air enters the annular orifice of the Vortex Air Amplifier. The ompressed air accelerates to sonic speed as it exits the orifice. At the exit, the sonic speed air creates a low pressure area (vacuum area) drawing in the surrounding air creating the amplification and utilizing the free ambient air to create large flows.

/ortex Air Amplifiers are quiet, safe, and naintenance free due to having no moving parts. /ortex Air Amplifiers give you high performance vithout noise.

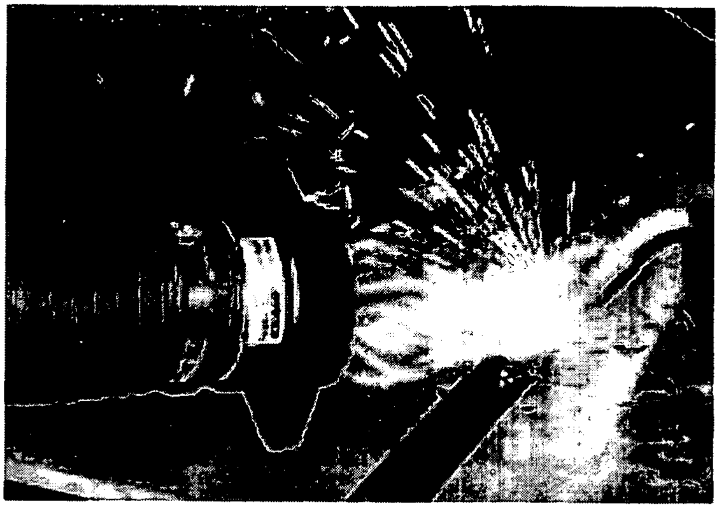
USES FOR VORTEX AIR AMPLIFIERS

- AIR CONVEYING
- VENTILATION
- COOLING
- BLOW OFF CHIPS
- EXHAUST OF FUMES
- PART CLEANING
- PURGING TANKS
- COOLING DIES AND MOLDS
- CLEANING OF PARTS
- DRYING OF PARTS

AMPLIFY AIR FLOWS
25:1

FEATURES	BENEFITS
• INSTANT ON & OFF • NO MOVING PARTS • CONTROLLABLE • NO NOISE	• LOW COST • NO MAINTENANCE • CONTROLLABLE • NO ELECTRICITY • NO GUARDS • MOUNTS EASY • MEETS OSHA SPECS

[Home] [Vortex Tubes] [Vortex Cool Tool] [Vortex CNC Coolers] [Vortex Air Amplifiers] [Vortex Air Curtains] [Vortex Air Nozzles] [Vortex High Thrust Jets] [Vortex Drum Pumps] [Contact Form] [Order Form] [Price List]



EXAIR®

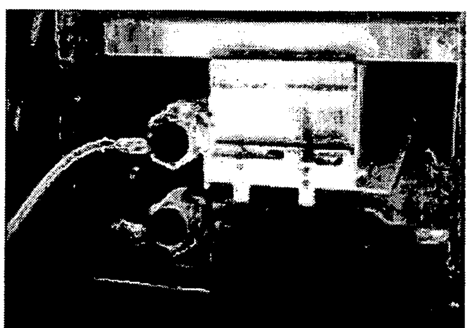
Air Amplifiers

Vent, exhaust, cool, dry, clean - with no moving parts!

MEETS OR EXCEEDS OSHA REQUIREMENTS OSHA

What are Air Amplifiers?

A simple, low cost way to move air, smoke, fumes, and light materials. Air Amplifiers utilize the coanda effect, a basic principle of fluidics, to create air motion in their surroundings. Using a small amount of compressed air as their power source, Air Amplifiers pull in large volumes of surrounding air to produce high volume, high velocity outlet flows. Quiet, efficient Air Amplifiers will create output flows up to 25 times their consumption rate.



Cycle time is dramatically reduced when aluminum castings are cooled with the high volume airflow of two Air Amplifiers.

Air Amplifiers have no moving parts, assuring maintenance-free operation. No electricity is required. Flow, vacuun and velocity are easy to control. Outlet flows are easily increased by opening the air gap. Supply air pressure can be regulated to decrease outlet flow. Both the vacuum and discharge ends of the Air Amplifier can be ducted, making them ideal for drawing fresh air from another location, or moving smoke and fumes away

Applications

- Vent welding smoke
- Cool hot parts
- Dry wet parts
- Clean machined parts
- Distribute heat in molds/ovens
- Ventilate confined areas
- Exhaust tank fumes

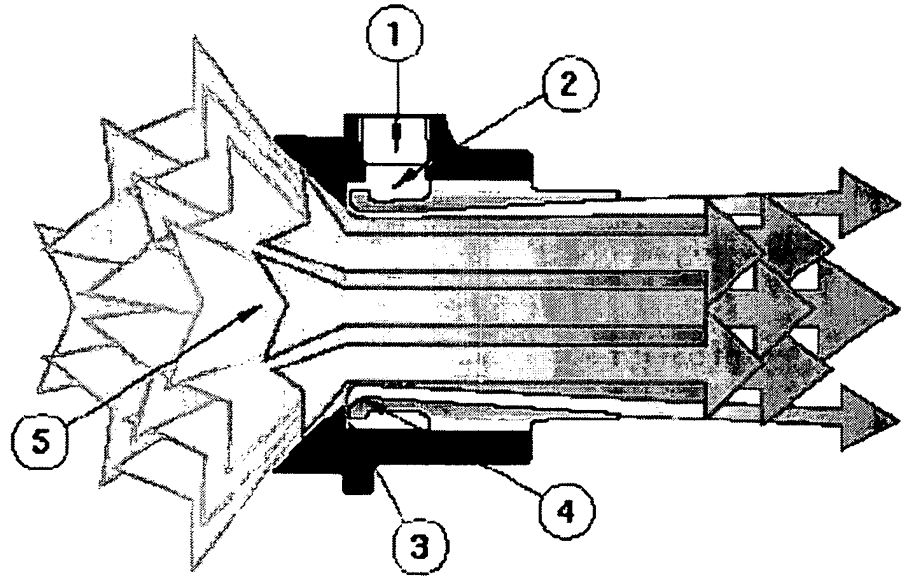
Advantages Compared to:
Fans:

- Compact, lightweight, portable
- No electricity
- Variable force and flow
- Ends are easily ducted
- No moving parts - no maintenance
- Instant on/off

Advantages Compared to:
Venturis and Ejectors:

- More airflow with less consumption
- Higher flow amplification
- Quiet
- No internal obstructions
- Meets OSHA pressure/noise requirements

How Air Amplifiers Work



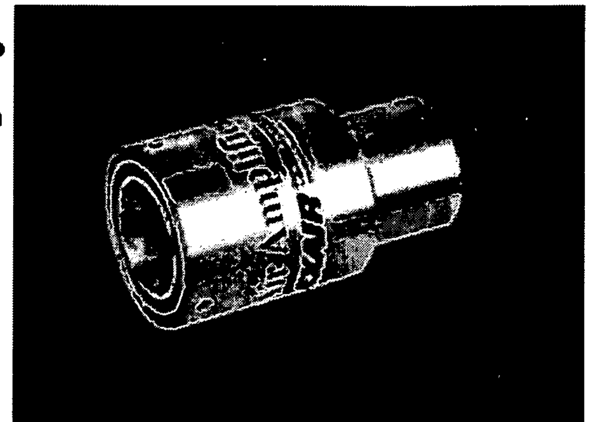
Compressed air flows through the inlet (1) into an annular chamber (2). It is then throttled through a small ring nozzle (3) at high velocity. This primary airstream adheres to the coanda profile (4), which directs it toward the outlet. A low pressure area is created at the center (5) inducing a high volume flow of surrounding air into the primary airstream. The combined flow of primary and surrounding air exhausts from the Air Amplifier in a high volume, high velocity flow.

Model Comparison

Air Amplifier Comparison	Efficiency	Sound Level	Mounting Flange	Flow Adjustment	Temp. Rating	Corrosive Applications
Super Air Amplifier	High	Low	Yes	With Shims	275°F (135°C)	No
Aluminum Adjustable Air Amplifier	Medium	Variable	No	Infinite (No shims)	275°F (135°C)	No
Stainless Steel Adjustable Air Amplifier	Medium	Variable	No	Infinite (No shims)	400°F (135°C)	Yes
High Temperature Air Amplifier	High	Low	No	With Shims	700°F (374°C)	Yes

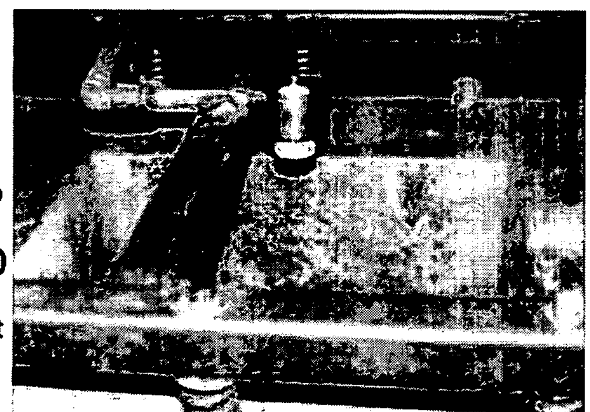
Special Air Amplifiers

EXAIR manufactures special Air Amplifiers suited to specific application requirements. The special Air Amplifier with grooved intake mounts to the suction tube of a dust collector and is held in place with set screws. The exhaust is easily ducted into the existing dust collection system or can be directed into a filter bag.



This special Air Amplifier acts as a "booster" for a maxed out dust collection system. The recessed groove on the suction side allows secure mountin to the existing dust collector intake tube.

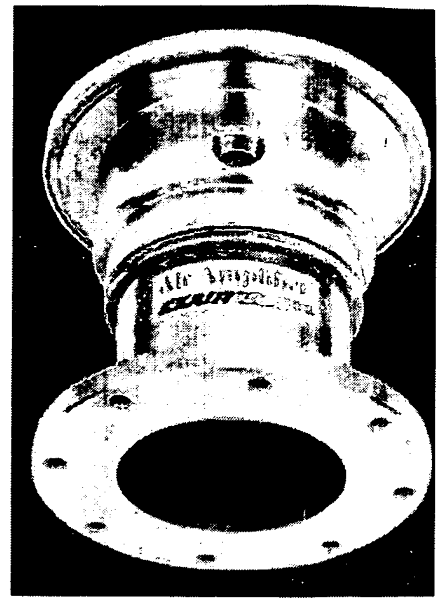
The Model 121021 High Temperature Air Amplifier (*shown on the right*) was developed for moving hot air to surfaces requiring uniform heating while in a furnace or oven. Modeled after our Super Air Amplifier, the High Temperature Air Amplifier is the most efficient for pushing high volumes of hot air to points that typically remain cool. This special design is rated for environments up to 700°F (374°C) and its surface is protected from heat stress by a mil spec. coating process (developed for the aircraft industry), allowing easy disassembly for changing shims or cleaning.



A Model 121021 High Temperature Air Amplifier directs hot air to a rotational mold cavity for unifor wall thickness of the plastic.

Another stainless steel version for flange mounting was developed as a fan back-up for exhausting flue gases from a furnace. In the event of a power failure, this special Air Amplifier can quickly evacuate the fumes that could be harmful to workers close by.

If you have special requirements, please contact an Application Engineer at 1-800-903-9247 to discuss the application.



This special stainless steel flange mount Air Amplifier was designed for exhausting hot flue gases from a furnace.

Super Air Amplifiers

Adjustable Air Amplifiers

[Home Page]

EXAIR®

Line Vac™

Convey parts, materials, waste - with no moving parts!

- **Highest Conveying Rates!**
- **Ideal for Long Distance!**
- **Mounting Brackets Available!**

Built to Last 5 yr. WARRANTY

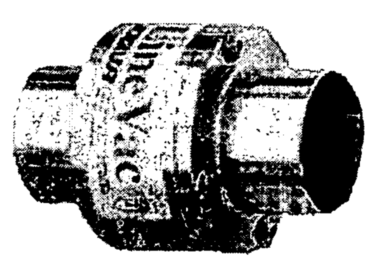
What is the Line Vac?

A fast, low cost way to convey:

- Plastic pellets
- Scrap trim
- Textiles
- Bulk Solids
- Food products
- Chips
- Paper
- Pills/tablets
- Small parts
- Shavings
- Sawdust
- Granules

A Model 6083 1-1/2" (38mm) Line Vac conveys plastic cap: from a barrel to an assembly station.

EXAIR's compressed air operated Line Vac connects to standard hose or tube to create a powerful in-line conveyor. The compact design features large throat diameters for maximum throughput capacity. Nine sizes in aluminum and eight sizes in stainless steel are suited to a wide variety of transfer applications.



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Why The Line Vac?

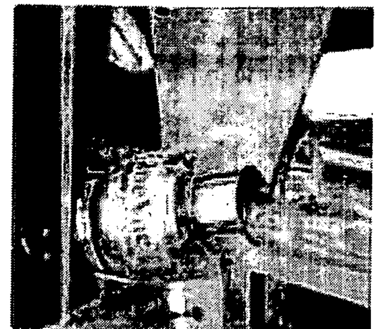
Line Vac conveyors are ideal for moving large volumes of material over long distances. A small amount of compressed air is injected through directed nozzles to produce a vacuum on one end and high output flows on the other, with instantaneous response. The material flow rate is easily controlled with a pressure regulator. An optional bracke permits easy mounting. No moving parts or electricity assures maintenance-free operation.

Applications

- Hopper loading
- Fiber tensioning
- Material conveying
- Waste/trim removal
- Chip removal
- Part transfer
- Filling operations

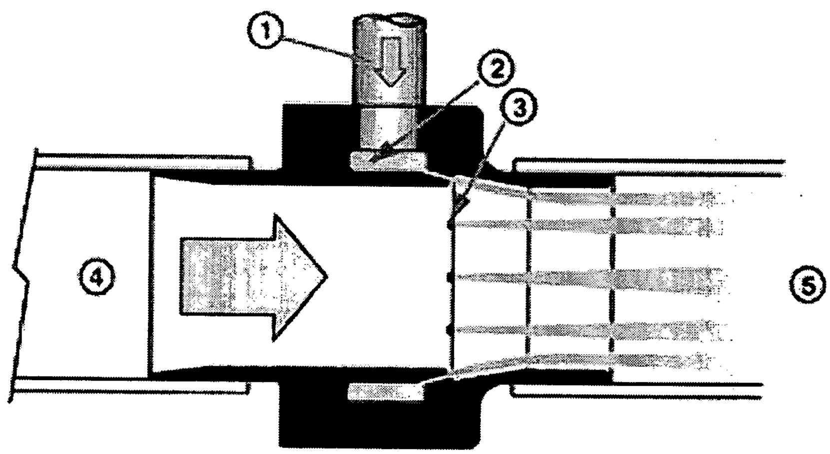
Advantages

- Compact
- Quiet
- No moving parts
- Fits standard hose or tube
- Aluminum or stainless steel
- Nine sizes
- High throughput capability

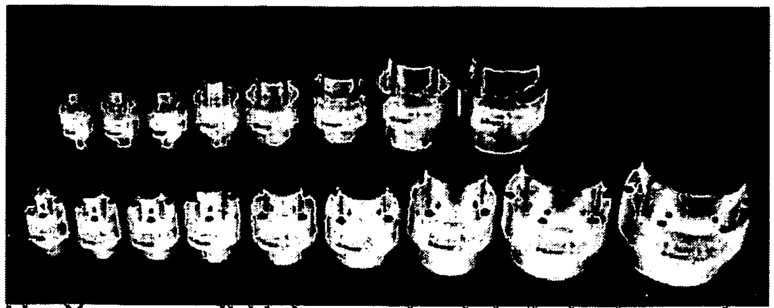


The Model 6084 2" (51mm) Lir Vac transports scrap trim to a waste barrel.

How Line Vac Works

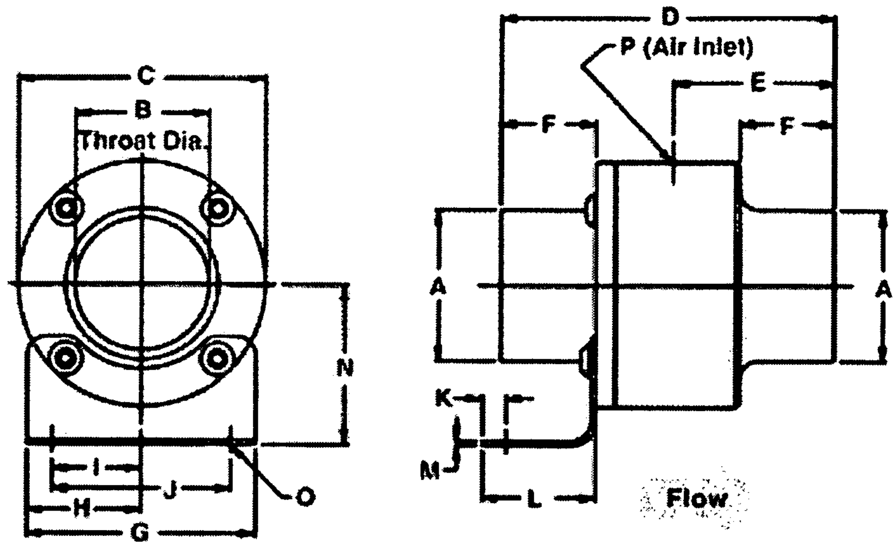


Compressed air flows through the inlet (1) into an annular plenum chamber (2). It is the injected into the throat through directed nozzles(3). These jets of air create a vacuum at the intake (4) which draws material in and accelerates it through the unit (5) at long vertical or horizontal distances.



Line Vacs are available in many sizes in both aluminum and stainless steel.

Dimensions



SS Models	Alum. Models		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
6060	6080	in	.75	.50	1.88	3.88	1.88	1.0	2.0	1.0	.76	1.52	.25	1.38	.06	1.44	.20	1/4
		mm	19	13	48	99	48	25	51	25	19	39	6	35	2	37	5	NP
6061	6081	in	1.0	.75	2.13	3.88	1.88	1.0	2.0	1.0	.65	1.3	.26	1.32	.06	1.56	.20	1/4
		mm	25	19	54	99	48	25	51	25	17	33	7	34	2	40	5	NP
6062	6082	in	1.25	1.0	2.38	3.88	1.88	1.0	2.5	1.25	1.0	2.0	.31	1.61	.06	1.68	.28	1/4
		mm	32	25	61	99	48	25	64	32	25	51	8	41	2	43	7	NP
6063	6083	in	1.5	1.25	2.75	4.38	2.13	1.25	2.5	1.25	.86	1.73	.25	1.44	.06	1.88	.28	3/8
		mm	38	32	70	111	54	32	64	32	22	44	6	37	2	48	7	NP
6064	6084	in	2.0	1.75	3.25	4.38	2.13	1.25	3.0	1.5	1.17	2.34	.28	1.48	.06	2.13	.28	3/8
		mm	51	45	83	111	54	32	76	38	30	59	7	38	2	54	7	NP
6065	6085	in	2.5	2.25	3.75	4.38	2.13	1.25	3.0	1.5	1.0	2.0	.31	1.44	.06	2.38	.28	3/8
		mm	64	57	95	111	54	32	76	38	25	51	8	37	2	60	7	NP
6066	6086	in	3.0	2.75	4.25	5.63	2.75	1.75	3.25	1.63	1.20	2.41	.41	1.44	.06	2.63	.28	1/2
		mm	76	70	108	143	70	45	83	41	31	61	10	37	2	67	7	NP
6067	6087	in	4.0	3.75	5.25	5.63	2.75	1.75	3.25	1.63	1.34	2.7	.31	1.59	.06	3.13	.28	1/2
		mm	102	95	133	143	70	45	83	41	34	69	8	40	2	80	7	NP
N/A	6088	in	5.0	4.75	6.25	5.63	2.75	1.75	4.13	2.06	1.70	3.47	.33	1.52	.06	3.63	.28	1/2
		mm	127	121	159	143	70	45	105	52	43	88	8	39	2	92	7	NP

Line Vac Performance

80 PSIG (5.5 BAR)	Air Consumption		Vacuum	
Model#	SCFM	SLPM	"H_2O	kPa
6060, 6080	10.7	303	-72	-18
6061, 6081	14.7	416	-42	-11
6062, 6082	25.9	733	-42	-11
6063, 6083	33	934	-36.8	-9
6064, 6084	45	1274	-28.5	-7
6065, 6085	58.5	1656	-23.5	-6
6066, 6086	68.5	1939	-14.7	-4
6067, 6087	95	2690	-13.6	-3.4
6088	128	3625	-10.5	-2.6

Selecting the Right Model

Some of the criteria used to select the proper model are:

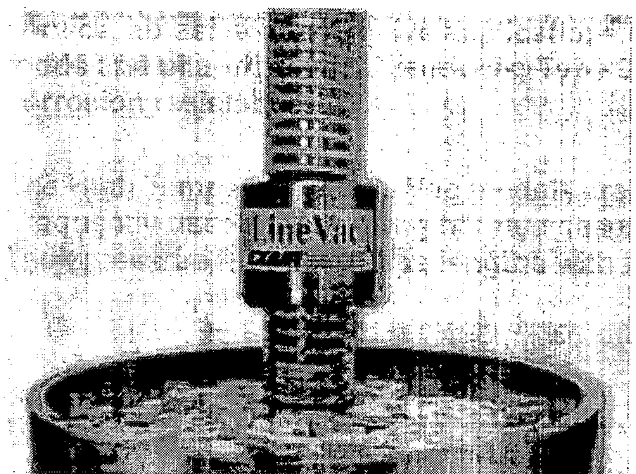
- **Diameter of parts being conveyed**
- **Diameter of hose or tube**
- **Rate (weight or volume)**
- **Stainless steel (Type 303 and 316) or aluminum**

Aluminum is the economical choice for general purpose conveying. Our standard stainless steel models (Type 303) offer good corrosion resistance and are ideal for fooc service, abrasive or corrosive applications. For critical applications including certain foods and pharmaceutical products, Type 316 stainless steel models provide excellent corrosion resistance.

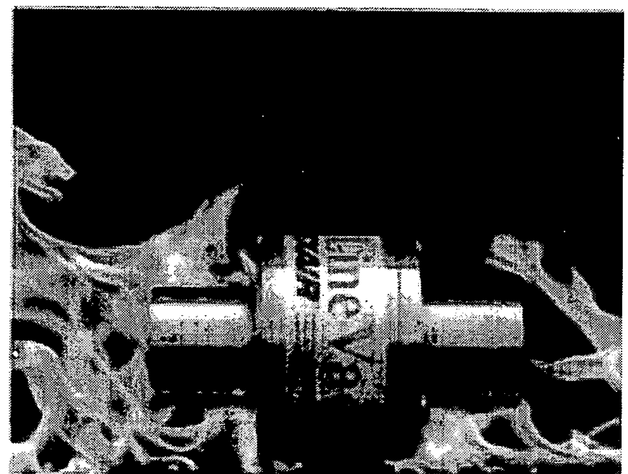
The High Temperature Line Vac models are suited for temperatures up to 900°F (482°C) Frequently used for sampling hot flue gases, the High Temperature Line Vac can resist back pressure from long pipe lengths with numerous bends.

Line Vac Comparison

Material Type	Temperature Rating	Corrosion Resistance
Aluminum Line Vac	275°F (135°C)	Fair
Stainless Steel Line Vac (Type 303)	400°F (204°C)	Good
Stainless Steel Line Vac (Type 316)	400°F (204°C)	Excellent
High Temperature Stainless Steel Line Vac (Type 303)	900°F (482°C)	Good



A 316 Stainless Steel Line Vac is used by a pharmaceutical company to convey pills and tablets to a packaging station.



High Temperature Line Vacs can resist temperatures to 900°F (482°C) and are available from stock in hose or threaded models.

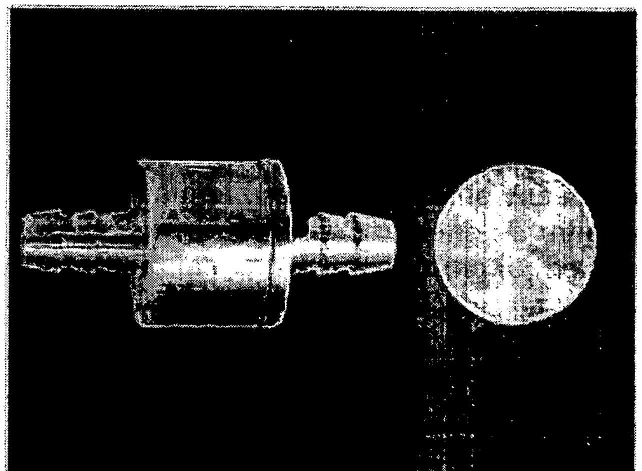
For assistance with product selection, contact an Application Engineer at 1-800-903-9247, or email us at techelp@exair.com

Special Line Vacs

EXAIR manufactures special Line Vacs suited to specific application requirements. Configurations and materials can vary according to the application requirements.

The special flanged Line Vac (*shown on the right*) is made of PVDF, a plastic that has a high chemical resistance. In this case, the 1-1/2" (38mm) Line Vac was regularly exposed to a chloride wash, a chemical that would corrode stainless steel. QF flanges were provided on each end to allow easy removal of the conveying hoses for cleaning purposes.

This special flanged 1-1/2 (38mm) Line Vac is made of PVDF to withstand a chloride washdown.



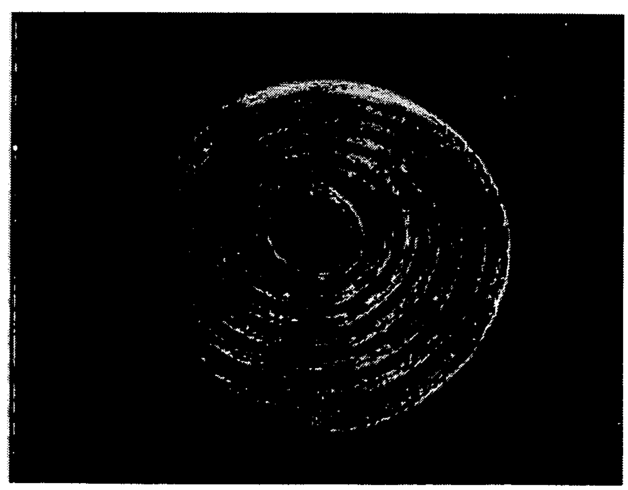
A special miniature Line Vac used to vacuum microscopic debris measures the same size as a penny!

The special miniature Line Vac with barb fittings (*shown on the left*) was designed for a manufacturer of integrated circuit chips. It was used to remove microscopic debris during the chip making process. This small Line Vac generated high vacuum and was the perfect configuration for the confined working space. It has also been used by another manufacturer to vacuum liquid and chips from small drilled holes.

If you have special requirements, please contact an Application Engineer to discuss the application.

Clear PVC Hose

EXAIR stocks 3/4" (19mm), 1" (25mm), 1-1/4" (32mm), 1-1/2" (38mm) and 2" (51mm) I.D. PVC hose in lengths up to 50' (15.2m). Ideal for conveying applications, the hose is very flexible and has a smooth internal bore that eliminates material build up. The reinforced heavy wall of this clear hose provides visual confirmation that the material is moving when air is supplied to the Line Vac. Temperature rating is -4 to 150°F (-20 to 66°C).



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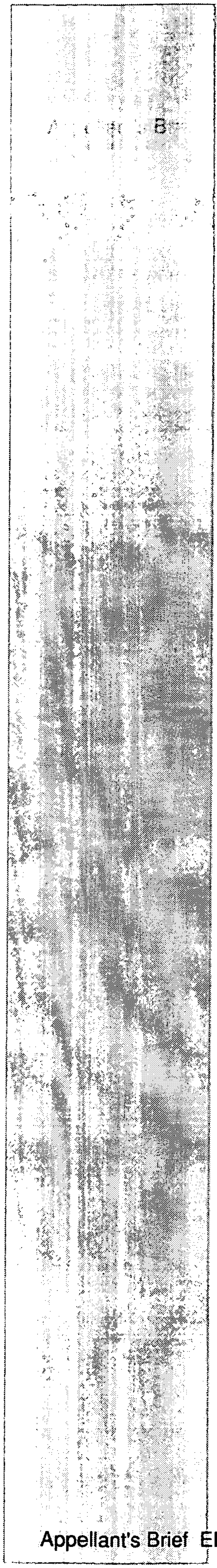


From: http://www.foxvalve.com/pdf/case_studies/Fox_CS31.pdf

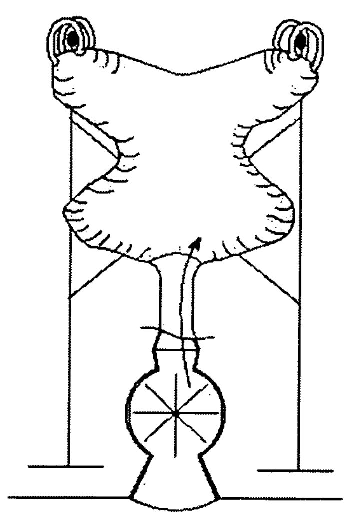
Applications of Fox Venturi Eductors

Case Study No. 31

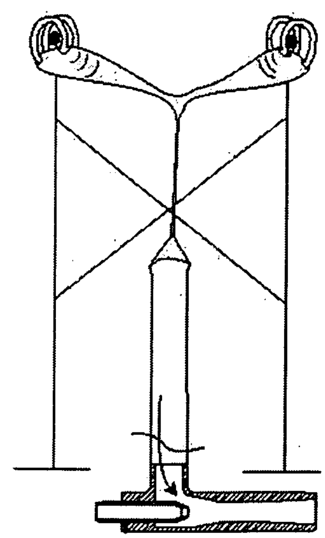
Material: Toner, Carbon Black; Particle Size - 5 - 15 microns, ultrafine Bulk Density - 15 - 20 #/ft^3

Problem: This multinational manufacturer of toner had a nasty dusty problem at their facility in Holland unloading Bulk sacks. Blowback from the rotary airlock frequently caused leakage at the seal where the sacks' 'elephant trunk' joined the convey line, and often prevented complete emptying. Even more problematic, however, was the slight inflation of the bulk sacks by airlock leakage while unloading. When almost completely empty, the bags were still puffed full of air, forcing workers to manually flatten them for storage, inevitably exhausting, in a dusty mess, the remaining toner.

Solution: Customer replaced the airlock on their bag unloading station with a Fox eductor. Not only was leakage at the connection eliminated, but upon emptying, the bags were collapsed completely flat by the 'vacuum' pulled on the suction side of the eductor.



Even when bag is almost completely empty, inevitable blowback from the airlock causes the bag to be partially inflated, creating a dusty mess when storing and stacking.

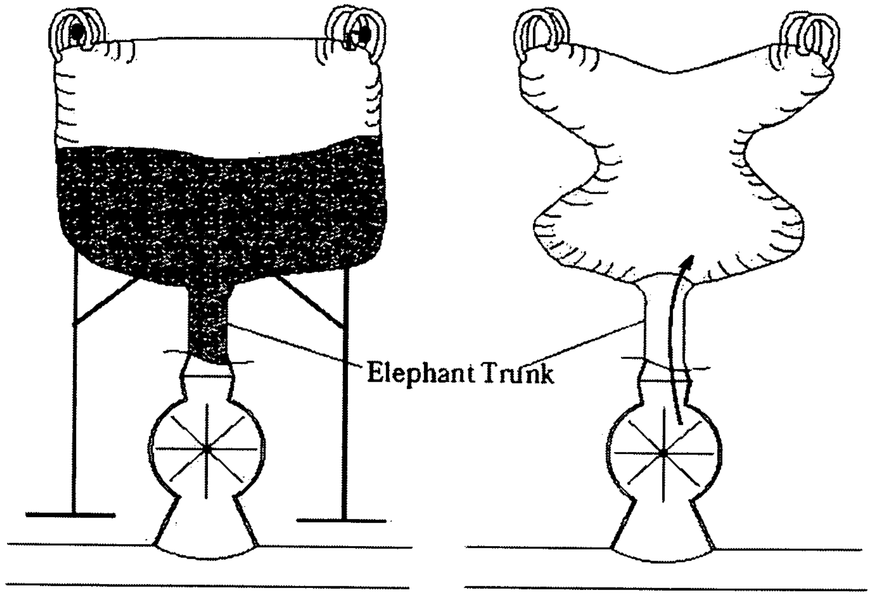


The venturi eductor creates enough vacuum to collapse the bag almost completely flat, creating a simpler, cleaner procedure for cleaning and storage.

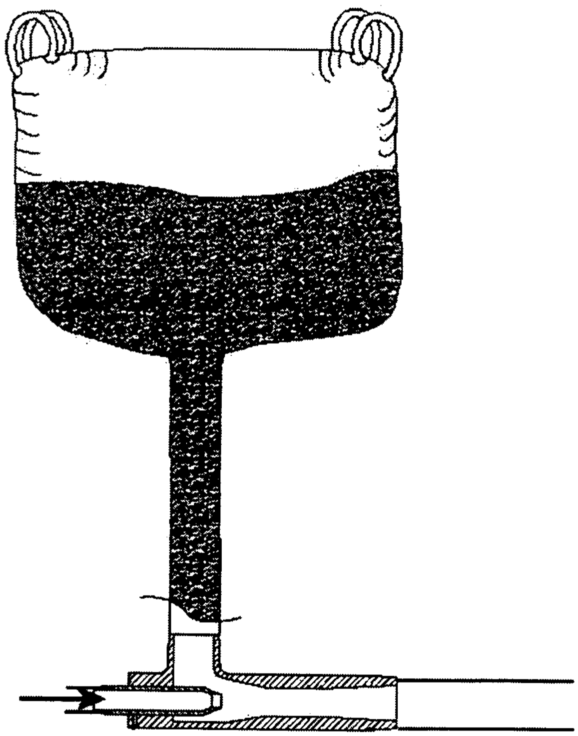
FOX
Dover, NJ USA
973-328-1011
Fax 328-3651

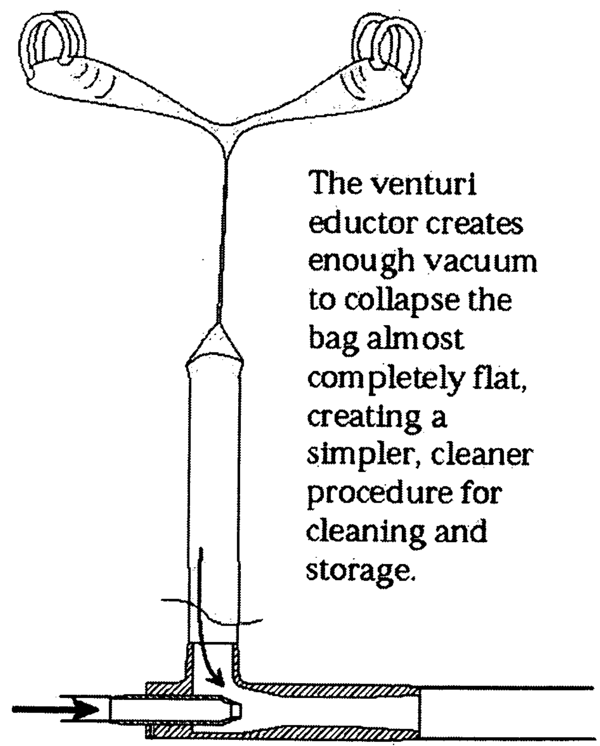
Applications of Fox Venturi Eductors

Case Study No. 31



Even when bag is almost completely empty, inevitable blowback from the airlock causes the bag to be partially inflated, creating a dusty mess when storing and stacking.

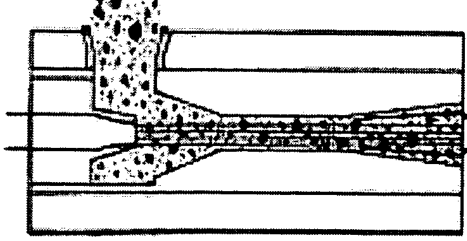




The venturi eductor creates enough vacuum to collapse the bag almost completely flat, creating a simpler, cleaner procedure for cleaning and storage.

Note : Maximum transfer rates with eductors are lower than those with airlocks. Depending on motive air pressure and piping geometry:

Max Convey rate in 3" lines - 3 tons/hr
Max Convey rate in 4" lines - 5 tons/hr



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Advances in Ophthalmic Technology

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I am going to talk a little bit about the UltraVac™ V1 coiled tubing and the value that it has had for me utilizing the Bausch & Lomb Millennium™ phacoemulsification unit. This tubing works on any phacoemulsification system, but the benefits are most noticeable on Venturi systems, like the Millennium and Premiere®. It is a very simple device and it fits readily on both the Millennium and the Premiere. It will allow a Venturi surgeon to safely use higher vacuum levels.

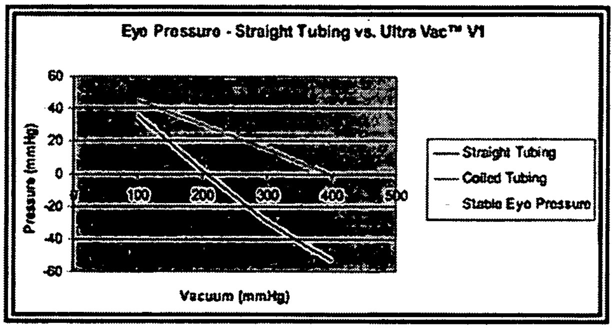
The unique feature of the UltraVac V1 tubing is the coiled section. Basically, we will talk about how it works, what advantages I've experienced using it, the relationship between vacuum and flow; and high pressure and vacuum. I will also tell you a little bit about my personal experience. Particularly in a Venturi system, vacuum and flow are very closely linked. What we do in a Venturi system is adjust the vacuum and the flow together. Flow is a slave to vacuum. The system works by passing compressed air over an orifice creating a vacuum and therefore, the higher the vacuum the higher the flow.

Most Venturi users, like myself, find that we can't really use very high vacuum levels. I rarely use a vacuum level higher than 150 mmHg. Many surgeons are not comfortable even over 100-120 mmHg with the Venturi system because surge and chamber collapse can occur at higher vacuum levels. Venturi users also tend to keep the irrigation bottle very high. If you walk into an operating room where a Venturi surgeon is working, you will probably see a very high bottle and lower vacuums than you might see if you walk into a peristaltic surgeon's operating room. What users like about Venturi systems is that when you want to attach the phaco needle to something you get a very rapid grab. When you want to let go of something you get a very rapid release. And so it does have a very exquisite on/off control over the vacuum.

What the UltraVac V1 tubing does is slow down the flow in the aspiration line. This seems like a very simple concept, but it has to be the right amount of coils, the right

diameter of tubing and the right length. It slows down the flow in the aspiration line so that the flow exiting the eye is less than or equal to the flow entering the eye. It smoothes out the flow almost like an automatic transmission in a car. As I mentioned, using very high vacuum levels in a Venturi system make it easy to get chamber shallowing and more surge.

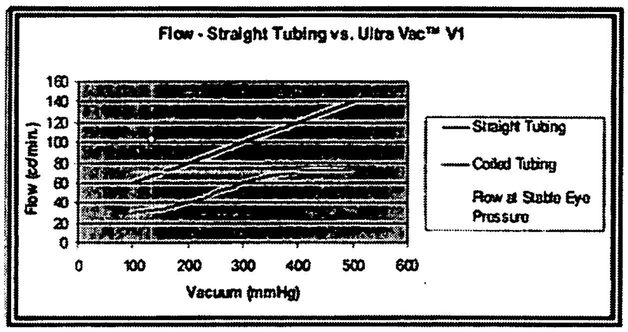
Figure 1



This diagram (Figure 1) illustrates the relationship between flow and vacuum using straight tubing. In a Venturi pump with the vacuum level at 100 mmHg, as the vacuum is raised the flow will increase significantly. However, with the UltraVac tubing the flow is dampened so that you don't have a shallowing of the chamber.

What we don't want to do is to create negative pressure in the system. With straight tubing as you increase the vacuum up to about 200 mmHg and beyond, you get into negative pressures, which can cause chamber shallowing and collapse. You can go all the way to 400 mmHg with the UltraVac tubing before you get into a negative pressure in the anterior chamber. Again, as a clinician, this means that you can go to higher vacuums with the Venturi system and not have chamber collapse and not have a surge. UltraVac tubing kept the chamber stable up to at least 250 mmHg in my experience. This has allowed me to run the vacuum on my Millennium from 150 - 250 mmHg instead of the 80 - 150 mmHg range I was previously using. It has made me able to use higher vacuums, creating more efficient phacoemulsification.

Figure 2



This diagram (Figure 2) shows flow versus vacuum again and demonstrates the same issue. In this example I started out with the vacuum range with which I was comfortable but after a little bit of experience I found that for me with the surgeon control, 150-250 mmHg was a very comfortable setting. Using tilt and tumble phaco, I experienced very rapid and efficient removal of relatively dense nuclear cataracts. Even if you just start out at 250 mmHg and put the phaco tip into the chamber and step on the pedal the system goes right up to full vacuum. There is

absolutely no shallowing of the chamber and, again, no evidence of surge.

As I was using this tubing and getting used to it, STAAR brought along the Sonic Wave for me to try and I was attracted to the Sonic unit, which generates absolutely no heat. With softer lenses, particularly refractive lensectomy, it is a really nice technique. You don't need much ultrasound on a refractive lensectomy. For me sometimes the other techniques such as cracking don't work because the lens is so soft. With the Sonic system you can go in, bevel down, set the tip against the nucleus and step on the pedal and the whole thing just comes up and out. You don't have to go on and off at all. You can just stay right on the pedal and it makes it a 10-15 second operation to remove a soft lens with no concern at all about generating heat. As best as I can tell, there is no concern about surge or chamber shallowing.

The Sonic Wave has a vented peristaltic pump and can go up to 400-450 mmHg. Using a Venturi, even with the UltraVac tubing, the ceiling is more like 250-300 mmHg. I like the Sonic mode on the Sonic Wave for softer lenses because there is no heat generated. There is still heat generated in the ultrasound mode, but not in the sonic mode. With a soft lens in the Sonic mode there is basically no heat and with the super capsular technique you can just go in, bevel down, put your tip against the nucleus, step on the pedal with the high vacuum and it just follows up and out.

The benefit of going to higher vacuums with the technique I use is that it makes the operation more efficient. It happens faster so that the lens follows up quicker. The advantage of using higher vacuums if you like to crack or chop is that you can engage the nucleus better with a higher vacuum. Higher vacuums also allow you to use less ultrasound power and a lot of people think that less power is better for the eyes in general. For me the advantage has mainly been the elimination of surge, a more stable chamber, and a faster operation given the way I do things. While I'll continue using the Millennium, I also happen to like the Sonic Wave enough that we have acquired one as well to utilize in some of our cases.

In conclusion, with the Millennium I am switching packs. We have ordered the UltraVac tubing for our ambulatory surgery center and for the Phillips Eye Institute because I like the fact that I can now go up to 250 mmHg rather than being held to 150 mmHg of vacuum. We also have acquired one of the Wave units to use in one of our other satellites because I like the Sonic mode. A primary advantage of both of these products is higher vacuum without surge or chamber collapse and reduction of that quick link between vacuum and flow.

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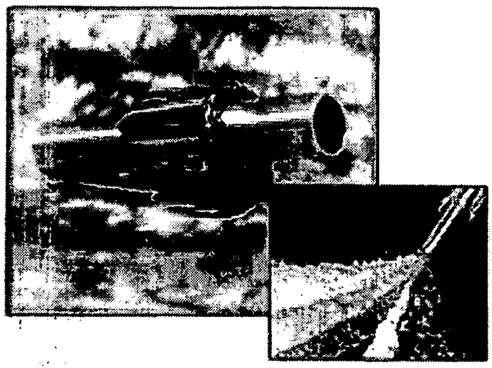
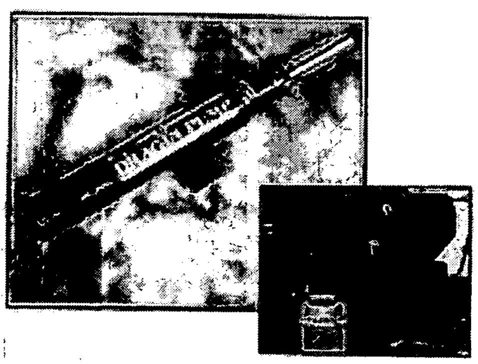


AIR PUMPS.

BLOVAC Air Pumps were designed to convey a vast range of products vertically and horizontally over extreme distances. Due to their unique design, the BLOVAC Air Pumps use two air flow principles, Venturi and Vortex, Compressed air entering an internal chamber is condensed and fired through several Venturi holes. These holes are angled in such a way as to create a Vortes principle, thus creating the vacuum. Due to the angle of the Venturi jets, air is exhausted in a spiral form enabling material to be conveyed via smooth bore hose or pipe downstream.

BLOVAC Air Pumps are made from either aluminium or stainless steel, and come in a range of bore sizes from 38 to 150mm and greater. BLOVAC Air Pumps currently convey such such items as: pharmacentical powders, plastic pellets, food products, grains, metal objects, fumes, paper and textile trimmings, broken glass, coins, coil springs and more.
In a blow mode these Air Pumps can be used to provide cooling for a number of industrial and manufacturing processes. Also for blowing down machinery, or even as an aid to combustion



DRAGIN PUMP

BLOVAC's Dragin Pump provides the solution to all your sump cleaning problems. It's small enough to fit in your hand...yet eat up tramp oil, used oil, waste coolants...even sludge...so fast you'll be amazed.

This versatile and inexpensive product will run on compressed air as low as 9.5cfm and is coupled with a design featuring no moving parts, requires no maintenance and with no waste solution travelling through the actual pumps, it comes with a three year warranty.

The Dragin Pump waste recovery unit will connect simply to a standard 44 gallon / 205 litre drum to give you a quick and efficient means of recovering waste liquids from : lathess, milling machines, EDM, surface grinders, sumps, open pils, and more.
Enabling you to not only recover, but to also store or dispose of such liquids as: coolants, metal chips, used oil, solvents, sludge, hydraulic oil, tramp oil etc. Giving your company the edge over those environmentally hazardous substances.

BV22 & BV11.

Whenever high powered vacuum cleaning or precise air pressure cleaning is required, the BV22 and BV11 blow / vacuum guns will connect directly to your compressed air line to provide the solution to a wide variety of industrial clean up problems.

On the vacuum mode they can be used to vacuum up metal filings, windscreen glass cuttings, fibreglass residue, ceramic dust. Sawdust, food crumbs, spilt powders, paper and textile trimmings, plastic pellets and any granulated material which is difficult to clean up. Also when attached with a conveying hose, are able to convey waste products over long distances.
In the blower mode they can be used for blow cleaning machine tools such as lathes, drills, milling machines, power saws etc. The BV22 and BV11 hand guns can also be used to provide cooling for a number of industrial and manufacturing processes. Also as aid to combustion.
BV22 and BV11 will vacuum fluids with safely, and there's no problem with electrical or mechanical breakdowns because they're air powered.

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X. RELATED PROCEEDINGS

None.